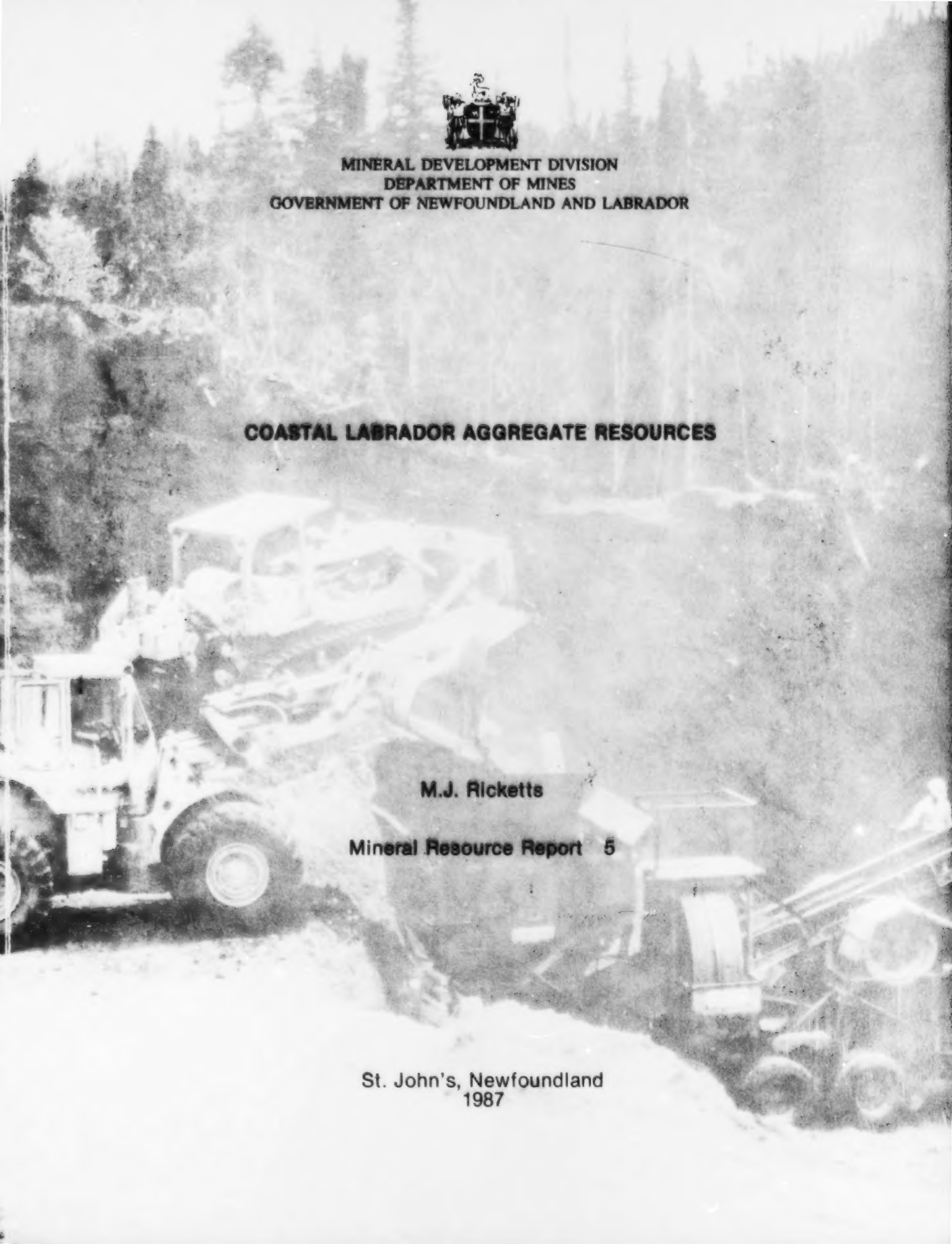

MINERAL DEVELOPMENT DIVISION
DEPARTMENT OF MINES
GOVERNMENT OF NEWFOUNDLAND AND LABRADOR

COASTAL LABRADOR AGGREGATE RESOURCES

M.J. Ricketts

Mineral Resource Report 5

St. John's, Newfoundland
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ABSTRACT

A study of the availability of aggregates in several coastal Labrador communities, from Lodge Bay in the south to Nain in the north, was conducted over a two-year period starting in 1983. Studies included surficial-terrain classification, field checks and aggregate-resource sampling. Many coastal communities do not contain adequate quality aggregates to meet current and future aggregate demands for construction. This report outlines the potential aggregate-resource areas and makes some recommendations to alleviate potential problems related to the supply of aggregates needed for construction and community development in these isolated coastal areas.

INTRODUCTION

Location and Access

Plans were made to complete detailed sampling during a two-year period for coastal communities from Lodge Bay in the south to Nain in the north (Figure 1). During 1983, field work was completed in three areas of coastal Labrador:

1) Lodge Bay to Charlottetown, including the communities of Lodge Bay, Mary's Harbour, Fox Harbour, Williams Harbour, Port Hope Simpson and Charlottetown

2) Cartwright to Black Tickle, encompassing Paradise River, and the summer communities of Spotted Islands, Domino and Bateau

3) Rigolet and surrounding area

Field work was concentrated generally in and around the community areas; some reconnaissance work and spot sampling were done in the more isolated areas between communities.

In 1984, field surveys were restricted to only two days of reconnaissance-level work in Postville, Hopedale, Big Bay, Davis Inlet and Nain, (Ricketts, 1985). Coastal Labrador communities from Forteau to Red Bay were previously mapped by Kirby *et al.* 1983.

Due to their isolation, most communities are highly reliant on the Goose Bay–Happy Valley area for the provision of many essential goods and services. Year-round air service and seasonal shipping are the main links to the outside. With the exception of Mary's Harbour and Lodge Bay, there are no road links between the coastal communities within the study area.

Present Investigation

The Coastal Labrador Aggregate-Resource Project, jointly funded by the Newfoundland Department of Mines and Energy and the Federal Department of Regional Economic Expansion (Coastal Labrador Subsidiary Agreement), was started in 1983 (Ricketts and Bragg, 1984) with the following objectives:

1) To map aggregate resources in and around coastal Labrador communities

2) To designate areas for extraction in specific planning proposals, e.g., municipal plans

3) To ensure that existing aggregates are reserved to meet appropriate needs and not sterilized by poor land-use planning.

Poor quality and low quantities of material in most of the communities studied make proper resource management and land-use planning essential.

The project was conducted using methods developed from the earlier Inventory of Aggregate Resources Program (Kirby *et al.*, 1983), and provides information on aggregate resources to assist in the preparation of guidelines for community growth and development. This data can aid municipal planning at the community or provincial level, ensuring that adequate aggregate resources are available so that orderly improvements can be made in transportation, sewage disposal, recreation and other public systems.

The main aim of this program was to identify sources of sand and gravel by conducting field sampling, testing and laboratory analyses. Analyses included field test-pits, petrographic analyses and laboratory silt/clay analyses. Proper resource-management techniques are proposed so that higher quality deposits may be available for future road topping or concrete uses, and not used as fill, ballast or for subgrade construction. In areas lacking quality-grade aggregates, alternative sources such as till having a low silt/clay content and/or suitable bedrock have been identified. Due to lack of overburden in many areas, bedrock aggregates are the only available construction materials. Geotechnical properties of the subsoil, overburden and bedrock materials were also identified to assist pre-engineering studies of route selection for roads or water/sewage mains.

Physiography

The study area is characterized by rock outcrops, large expanses of barrens, burnt-over areas, boglands and dense forest. Extensive river valleys dissect the region, some having lengths greater than 125 km, commonly associated with glaciofluvial outwash deposits. The geographical outline of this region is discussed by Hare (1959), who completed a photo-reconnaissance survey of Labrador–Ungava primarily to determine vegetation type; drift cover and physiographic type were noted as a secondary objective. Grant (1971) completed a geomorphologic study of the Lake Melville area, including all the communities between Lodge Bay and Postville. Fulton *et al.* (1974) conducted terrain studies in undeveloped areas in the region.

General Geology

The study area is underlain by parts of the Grenville and Nain structural provinces (Greene, 1970). A summary of the geology is presented in Table 1.

SAMPLING AND ANALYTICAL TECHNIQUES

Introduction

The precision and productivity of the aggregate-resource program in coastal Labrador was limited by the sampling methods and a two-month field program. The absence of heavy equipment in the coastal areas meant that backhoe test-piting could not be carried out. Also, forest cover made airphoto interpretation and ground checks difficult in some localities. This problem was greatly compounded in areas of dense forest where ground checks were slow and tedious.

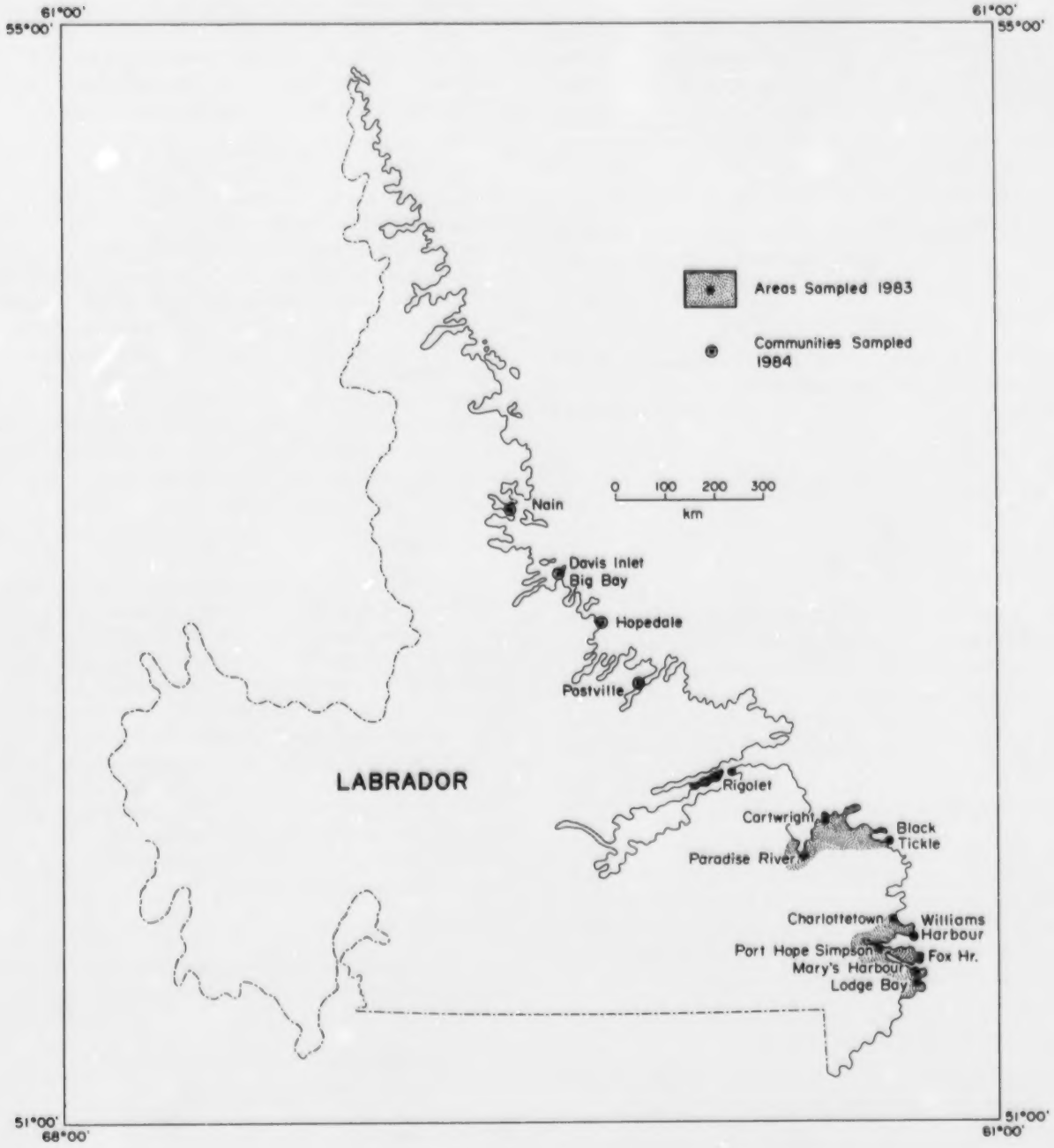

Figure 1: *Aggregate-resource study areas in coastal Labrador.*

Table 1. General geology of coastal Labrador communities (after Greene, 1970).

Community	Geological Age	Description
Mary's Harbour Lodge Bay Williams Harbour Black Tickle Cartwright	Helikian and/or earlier(?)	Granite; mainly pink quartzofeldspathic gneiss, commonly banded and migmatitic, locally porphyroclastic; minor amphibolite, quartz-rich gneiss, sillimanite gneiss, sillimanite- and garnet-bearing schists, and calc-silicate rock
Port Hope Simpson Fox Harbour	Neohelikian and/or Aphebian	Mainly garnetiferous biotite–quartz–feldspar paragneiss, probably derived in part from the Seal, Croteau and Aillik groups
Paradise River	Neohelikian and earlier(?)	Granite to granodiorite, massive to poorly foliated, porphyritic in part (includes some granitic gneiss and minor syenite, generally with gradational contacts)
Charlottetown	Paleohelikian	Gabbro, norite, anorthositic gabbro, troctolite, diorite, derived basic gneiss and amphibolite (includes Shabogamo Intrusive Suite and its equivalents)
Hopedale Postville Big Bay	Archean	Granite and granodioritic gneiss, migmatite, granulite, amphibolite; minor paragneiss and metasedimentary rocks; small ultrabasic intrusions included; diabase dykes locally abundant
Makkovik	Aphebian	Feldspathic quartzite, conglomerate, argillite, basic volcanic rocks, and metamorphic equivalents of the Aillik Group
Davis Inlet Nain	Paleohelikian	Anorthosite suite; anorthosite, anorthositic gabbro, leucotroctolite, minor gabbro, monzonite, granodiorite, and ferrosyenite

In addition, cemented B soil horizons or stony overburden commonly made penetration by hand-dug pits difficult or impossible, such that locally the parent-mineral soils (C horizon) could not be reached. Natural exposures were rare and generally restricted to major river valleys. These valleys contain fine grained postglacial sand or gravel deposits, but unfortunately, are usually considerable distances away from or not accessible to those community areas lacking adequate aggregate reserves.

Aggregate Sampling

Field sampling was conducted during foot, boat and helicopter traverses. Where possible, samples were taken from naturally occurring exposures such as stream cuts, lake shores and gullies; these samples were free of plant debris and topsoil. If natural exposures were not available, samples were taken from hand-dug pits that extended wherever possible into the C soil horizon. Where exposures permitted, channel sampling or multiple-spot sampling was used to ensure a representative sample.

All field and sieve data were placed on two separate forms. Form I provides site information, including data on location, landforms, stratigraphy, ice-movement indicators, and notation for photograph numbers and extra notes. Form II provides a field description of the sample, including data on field sieve analyses, field pebble analyses and laboratory sieve analyses.

Field sieve analyses were conducted on all samples containing greater than 8-mm-size material. Approximately 10 to 20 kg of material were sampled, weighed and sieved through a bank of four 30-cm-diameter sieves (openings of 63 mm, 31.5 mm, 16 mm and 8 mm). The total sample weight and the weights retained on each field sieve and canvas were recorded on Form II. A 200- to 500-g split of the finer than 8-mm fraction was retained for laboratory sieve analyses. A split (100 to 200 pebbles) of the greater than 16-mm pebble fraction of each sieved sample was retained for lithological analyses.

Mineral Aggregates–a brief description

Mineral aggregates, as used in the context of this report, are defined as any hard, inert material such as sand, gravel, crushed stone, stone or other mineral material that is used in the construction industry (Carter, 1981). They are used extensively in all types of construction activities related to domestic, industrial or other developments. Road construction is one of the larger consumers of aggregate materials. From a municipal viewpoint, street, water and sewer service, driveway construction and building foundations figure most prominently. Backfill is another major component, as are topsoil-type materials for landscaping.

Not all materials are suitable as aggregate. Vanderveer (1983) defines the quality of aggregates by their composition. Aggregates containing too much or too little silt/clay when

used in road construction can cause instability, such as slumping or flowage in the case of too much fine material, or the loss of compaction properties in the case of too little fine material. Too much fine material in concrete or asphalt can interfere with the bonding process between the aggregate and the cementing agent. The presence of deleterious substances such as a silt–clay coating or iron-oxide staining on the surface of the aggregate and the presence of certain friable or blade-shaped fragments often cause bonding problems with the cementing agent, or the breakdown of particles with time.

Aggregates are high-volume, low-cost materials. If these materials are located far from the area of construction, it will at best lead to increased costs of construction or at worst act as a limiting factor to developments. The cost of transportation represents, on average, 30 percent of the delivered cost, although long-distance transportation may increase the cost to 60 percent of the delivered price (D. Vanderveer, personal communication, 1982). In order for any development to proceed, aggregate materials are an essential component at some stage. It is therefore to the advantage of the municipality and its inhabitants to ensure that adequate, nearby reserves of aggregate materials are protected from conflicting land uses, such as residential and recreational developments that often encroach on these resource areas.

Pebble Rock Types

Pebble lithological studies consisted of a review of the geological literature related to the study area, and a determination of the percentage of each rock type found in the pebble samples.

The lithological analyses also included information on the silt/clay coating, weathering, staining, sphericity, rounding, fracture faces, mineralogy, and textures of the various rock types present in a given pebble sample.

A petrographic number was calculated for each sample using procedures similar to CSA standard A23.2.30 (Canadian Standards Association, 1973). This number, ranging between 100 and 1000, is derived by taking the sum of the percent of each pebble rock type present and multipling this number by a factor (based on mineral soundness and durability) assigned to that rock type. The lower the number, the better the quality of the aggregate material. Appendix I outlines the procedures used in petrographic analyses in more detail.

Laboratory Study

The laboratory program consisted of sieve analyses of the sand–silt/clay (-8 mm) fraction of the sample split returned from the field. The analyses involved drying, splitting the sample to a manageable size (70 to 140 g), and wet and/or dry sieving of each sample. Appendix II outlines the procedures used in laboratory analyses. A split of each bulk sample (greater than 8 mm) was stored for future analyses and/or reference.

Computer Program

A database management system (Atkinson, 1984) was used to record all field and laboratory data. This system will allow for the search and retrieval of data on file, and the reporting of these data in a variety of formats readily understood by potential users.

DATA PRESENTATION

Samples and Rock Types

In total, 213 samples were collected for particle-size analyses and lithological investigation. A breakdown of sample types and totals are given as follows: sand (79), gravel (55), till (50), rock (12), clay (9) and silt (8).

Bedrock samples collected in the field were used as reference samples to assist pebble analyses. Petrographic numbers vary widely, from 100 in the Cartwright area to 640 in Rigolet. A summary of petrographic analyses for each community is given in Table 2. Appendix III gives a more detailed analyses of petrographic results. Subsequent to the collection of this data, a survey of a number of the communities was commissioned by the Department of Mines and Energy (Newfoundland Geosciences Limited, 1985) to locate sources of armour stone. This type of stone is required to provide protection for various marine structures in community areas such as breakwaters and sea walls. Potential sites for armour-stone quarries occur near Lodge Bay, Mary's Harbour, Williams Harbour and Cartwright. Two other areas of armour stone are located south of the aggregate-resource study area. These are located at Pinware and Red Bay. Test results completed on rock samples collected in these areas are shown in Table 3.

Grain-size Distribution

Grain-size analyses are available for all granular samples collected in the field. Percentages of gravel, sand and silt/clay for individual samples are listed in Appendix III. Cumulative graphs (Figure 2) showing percentages of gravel, sand and

Table 2. Petrographic analyses of pebble samples collected in coastal Labrador communities

Community	Petrographic numbers
Lodge Bay	0300, 0201
Mary's Harbour	0147, 0183, 0300
Fox Harbour	0390, 0584, 203
Williams Harbour	0100, 0120, 0127, 0271, 0395, 0395
Charlottetown	0100, 0210, 0260, 0289
Port Hope Simpson	0110, 0250, 0260, 0280
Cartwright	0100, 0140, 0170
Paradise River	No pebbles collected; samples were too silty and wet for sieving
Black Tickle	0580
Rigolet	0176, 0220, 0270, 0640

Table 3. Results of armour-stone study (Newfoundland Geosciences Limited, 1985)

Communities	Tests			
	L.A. Abrasion %	Soundness %	Relative density (specific gravity)	Absorption %
Lodge Bay	39.2	1.76	2.64	0.53
Mary's Harbour	38.0	1.65	2.67	0.68
Williams Harbour	22.5	0.89	2.79	0.43
Cartwright	40.7	1.12	2.75	0.76
Pinware	50.4	8.88	2.66	1.07
Red Bay	42.0	1.30	2.64	0.83

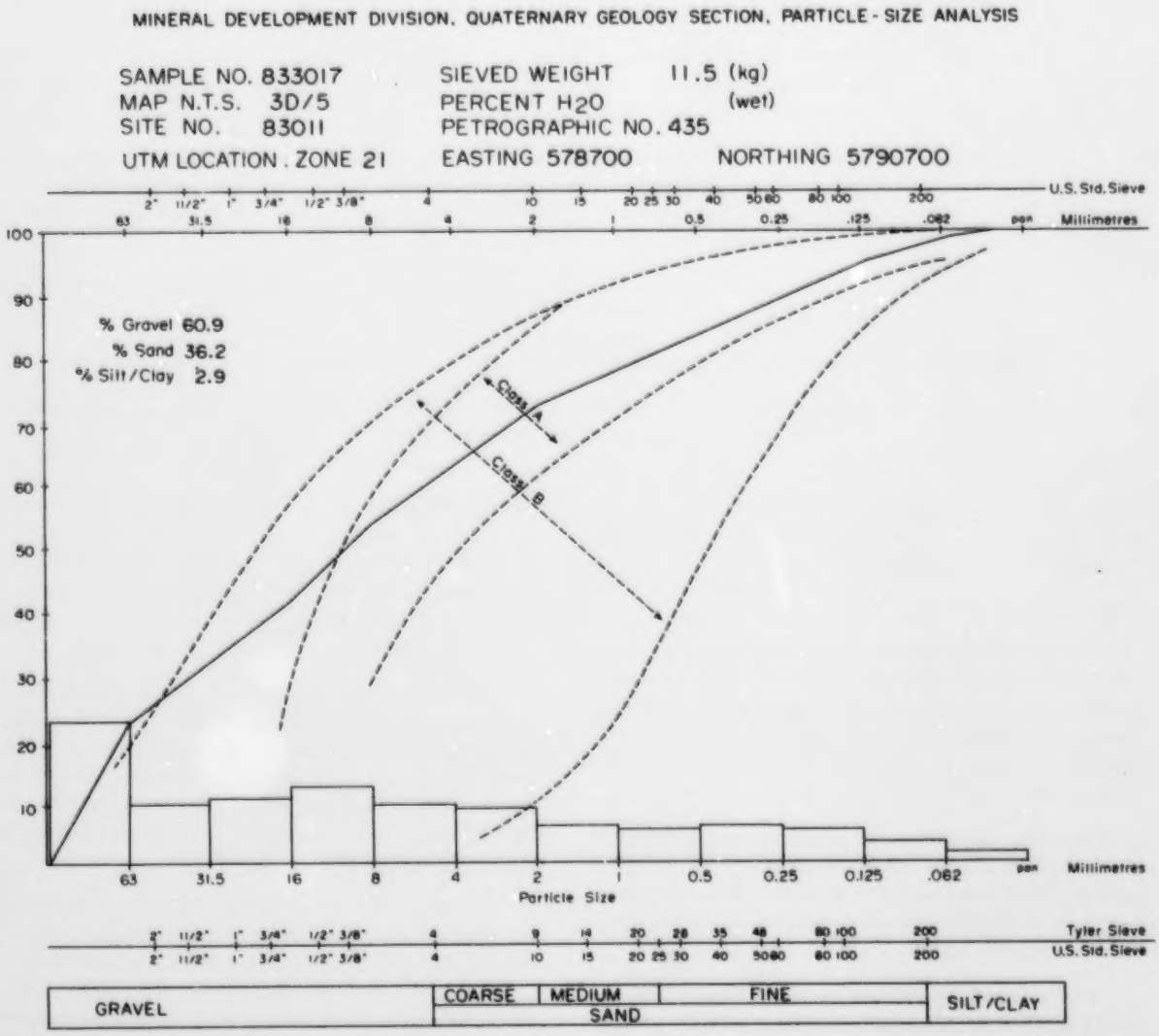

Figure 2: *A typical cumulative graph showing grain-size distribution and comparisons to class A and B material used in engineering standards; a petrographic number is also given.*

Table 4. Landform classification: genetic-category definitions

Symbol	Material and process	Origin and characteristics of material
A	Alluvial	Usually less than 1 m thick and confined to material deposited at or near modern-day flood-plain levels; similar to glaciofluvial material in particle size
C	Colluvial	Product of mass wastage or rock falls; massive to moderately stratified, nonsorted to poorly sorted sediments containing usually angular material ranging from clay to boulder size
E	Eolian	Material transported and deposited by wind action; usually medium to fine grained sand and silt, well sorted, poorly compacted, and may be massive or show internal structure such as cross-bedding
G	Glaciofluvial	Material deposited from glacial water and usually lacking in fines; moderately sorted and possibly stratified, normally 1 m thick, and located above present-day flood levels; post-glaciofluvial materials have been included in this category
L	Lacustrine	Material having settled from suspension in bodies of standing fresh water; includes stratified and sorted sand, and silt–clay, and/or gravel created from shoreline wave action and deposited above present day lake levels
M	Marine	Usually clay and silt, although gravel and sand may occur locally; moderately well stratified and sorted, and in some cases contain shells; includes deposits above present day marine limits; glaciofluvial- or fluvial-derived sediments deposited in a marine environment are not classified as marine unless they are substantially modified by marine wave action
T	Morainal	Unsorted and structureless material such as till derived through glaciation; usually contains material with size ranges from boulder to silt–clay
O	Organic	Usually poorly drained accumulations of decomposed peat mosses and other organics
R	Rock	Defined where clearly visible or covered only by a thin soil mat or regolith veneer up to 1 m thick; not derived from any of the above processes

silt/clay are also available for these samples. Cumulative-graph forms also record petrographic numbers for samples containing material coarser than 16 mm.

Maps

Two sets of 1:50,000 scale maps were compiled for the study area. One set outlines the surficial geology (landform classification); the other set gives the aggregate-resource data. These maps are available in Open File LAB (642). The 1:50,000 scale data has also been compiled onto 1:250,000 scale summary index maps.

Since little information was gathered during the two days of reconnaissance in communities north of Rigolet, 1:250,000 scale summary maps were not produced. Map information is available at 1:50,000 scale and is contained within this report under community review.

Surficial mapping. An integral part of the program has been 1:50,000 scale, reconnaissance-level, surficial-geology (landform classification) mapping. This mapping was compiled from the interpretation of black and white airphotos of approximately 1:50,000 scale. This data provided the framework for field investigations by outlining areas of potential deposits, thereby constraining the area for field traversing and sampling. Through field checks and sampling, the surficial-geology maps were updated prior to transferral to cronaflex base maps. Work has been completed on all or portions of 28 different 1:50,000 scale surficial-geology maps (Figure 3) required to cover the study area.

Landform classification used in surficial mapping is the same as that used by Kirby *et al.* (1983). Each area outlined on a surficial-geology map is assigned a landform system consisting of up to three genetic categories (Table 4), and morphological modifiers (Table 5) that designate the terrain types within each area (Table 6). Procedures for landform classification are listed in Appendix 5.

Aggregate-resource mapping. Fifteen 1:50,000 scale aggregate-resource maps (Figure 4) were compiled to depict zones of aggregate potential. These were initially defined from 1:50,000 scale airphotos and subsequently field checked during sampling, and zoned according to aggregate potential, as outlined in Figure 4. Sample numbers, location and type of sample collected are also shown on these maps. Areas with no zone designations are interpreted as having little or no known potential. It should be noted that the boundaries around

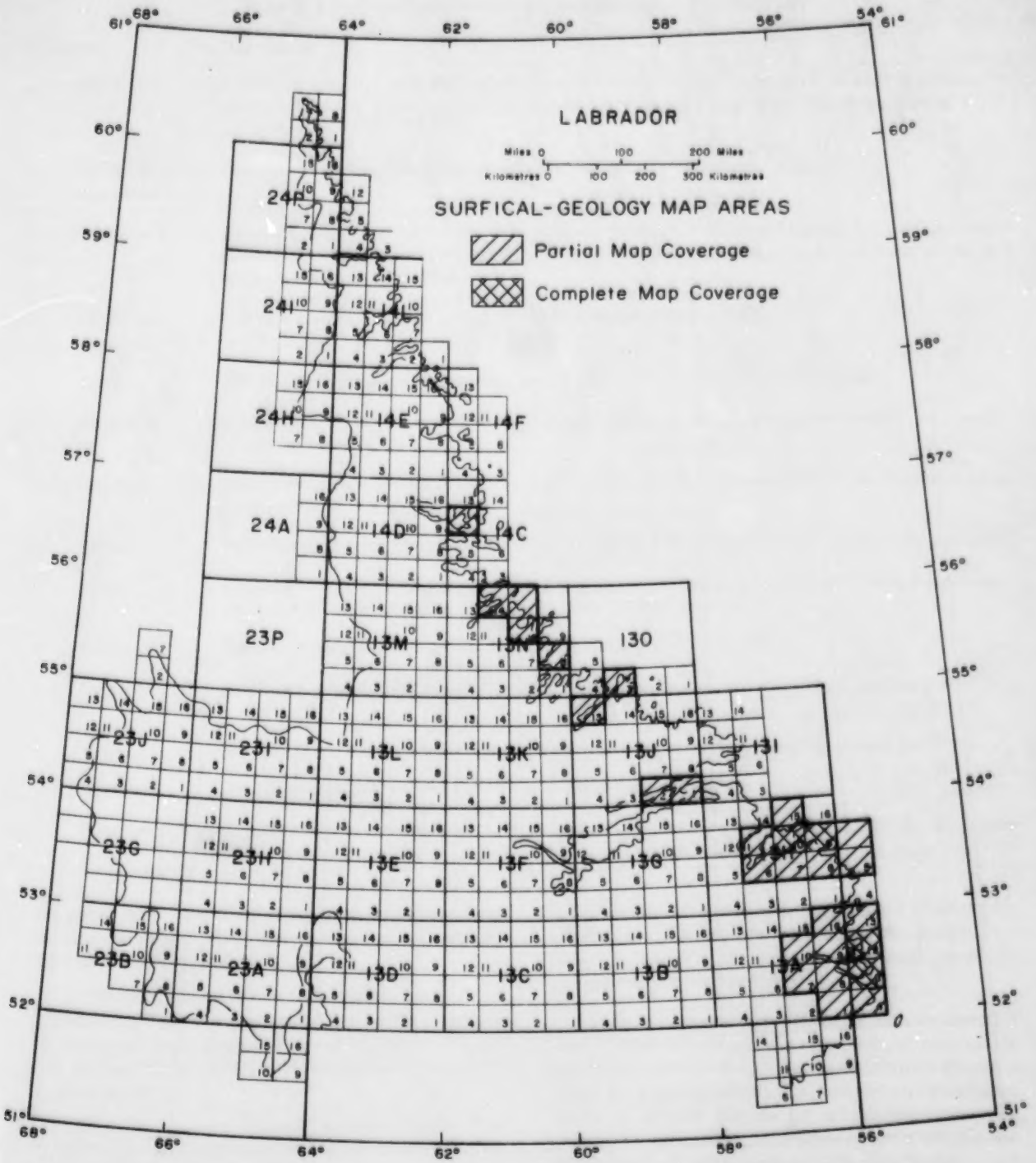

Figure 3: *Index map of 1:50,000 scale surficial-geology mapping.*

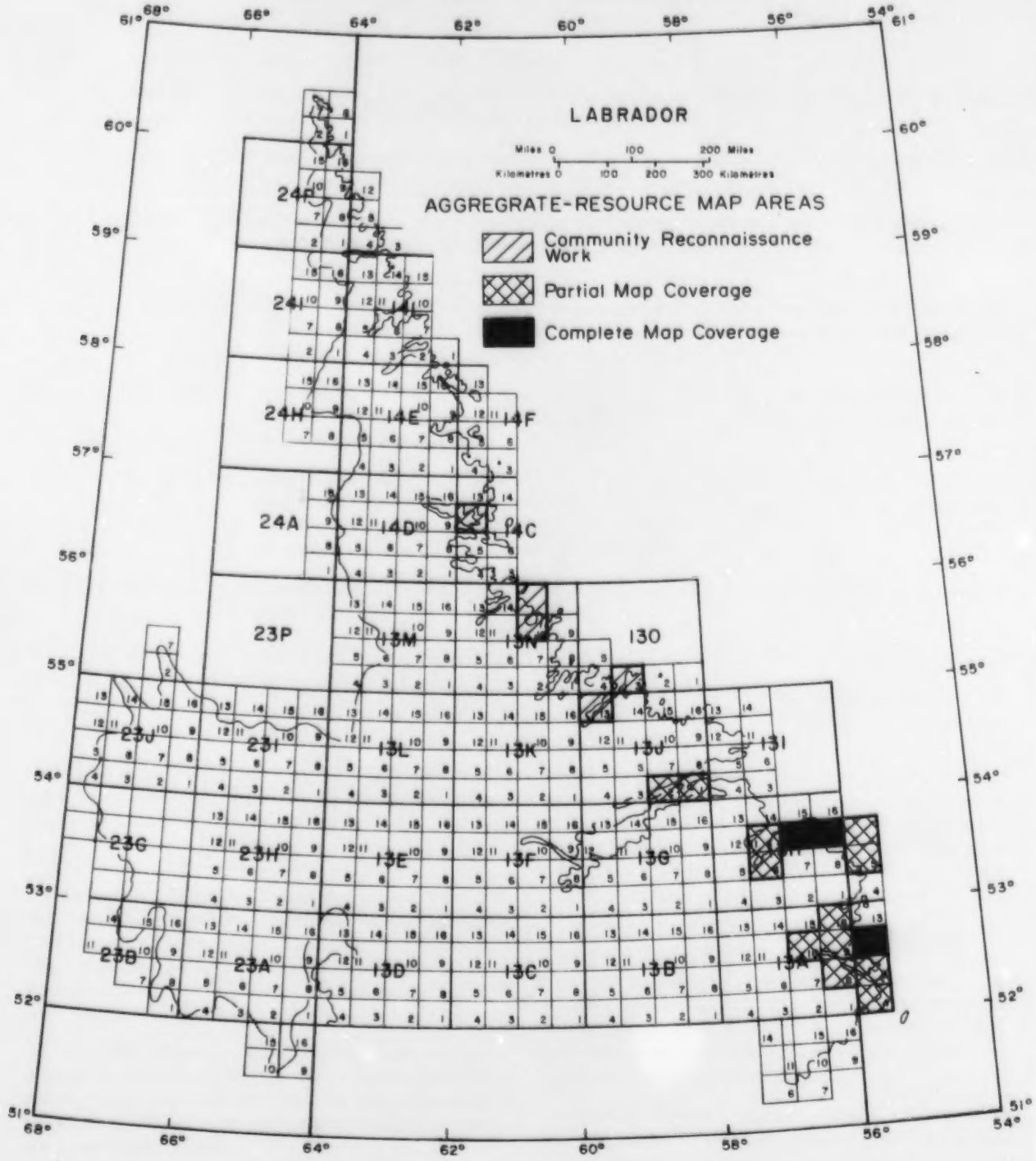

Figure 4: *Index map of 1:50,000 scale aggregate-resource mapping.*

Table 5. Landform classification: morphological-modifier definitions

Modifier		Description
a	apron	A sheet of sand or gravel that lies for some distance in front of a terminal moraine or extends out from the banks of a lake or river; also, a series of coalescing colluvial fans at the base of a rock escarpment
c	concealed by vegetation	Indicates lack of appreciable overburden above bedrock or colluvial surfaces
d	drumlinoid	Elongated ridges 3 to 50 m high, 15 to 1000 m long and 5 to 3000 m wide that formed independent of bedrock control in till; the ridges are generally tapered in the down-ice direction and are parallel to the direction of glaciation
e	eroded and dissected	Cut by a series of closely spaced gullies or deeply incised channels
f	deltaic	Fan-shaped deposit having a surface that is either flat or dips away from the apex
h	hummocky	A collection of closely spaced steep-sided hills exhibiting no pronounced orientation, i.e., usually chaotic in plan
k	kettled	Surface depressions formed by melting of ice blocks in glacial sediments (also includes karst depressions in bedrock)
l	lineated	Features raised above the surrounding terrain exhibiting a pronounced parallel or subparallel orientation
p	plain	Deposits greater than 3 m thick, usually areally extensive, that have few definable surface expressions and mask all bedrock features (includes extensive blankets of drift)
r	ridged	Narrow, steep-sided, elongate hills (includes eskers)
t	terraced	Step-like topography, including a scarp face with a usually level surface above it, e.g., marine terrace, kame terrace
v	veneer	Deposits 3 m thick that usually reflect features of the underlying topographic rock unit
w	weathered	A veneer, usually 1 m thick, of *in situ* decayed rock or sediment
x	complex	Usually indicates numerous esker ridges in close proximity, but may also be used where any genetic category exhibits numerous surface expressions in a small surface area

designated areas (zones) are arbitrary, as determined from the airphoto and field investigations, and may not represent the true extent of any deposits.

1:250,000 scale summary index maps. Two sets of 1:250,000 scale maps were compiled. Each set is composed of three maps each. These maps cover NTS areas 13A and 3D, 13H and 3E, and 13J. A brief description of these maps is given below.

Coloured aggregate-resource summary maps. The 1:50,000 scale aggregate-resource map data has been drafted onto 1:250,000 scale, multi-coloured, summary index maps, which accompany this report. These maps, similar to those by Kirby *et al.* (1983) illustrate sample type and location, as well as generalized zones of aggregate potential as summarized from the 1:50,000 scale aggregate-resource maps. Due to the high density of sample sites at some localities, not all samples have been transferred to the 1:250,000 scale summary maps. Multiple samples at individual localities are usually indicated by the predominant or most significant aggregate type at that particular site.

Bedrock aggregate maps. In many areas the Labrador coast is devoid of any surficial or overburden material. As part of the Coastal Labrador Aggregate-Resource Project, a review of the geological data was made and a reconnaissance survey of bedrock sources for suitable aggregates was undertaken. An airphoto, structural-lineament analysis was also completed to assist in ground-water investigations in and around community areas. These data are presented as a map series that includes a compilation of existing geological mapping, with the emphasis placed on rock types and the geotechnical aspects of the rock units. Table 7 gives the petrographic range of bedrock types in community areas.

Table 6. Surficial-landform classification

Morphological Modifier		Genetic Category								
		Morainal	Glaciofluvial	Alluvial	Marine	Lacustrine	Eolian	Colluvial	Organic	Rock
		T	G	A	M	L	E	C	O	R
drumlinoid	(d)	Td								
plain	(p)	Tp	Gp	Ap	Mp	Lp			Op	
hummocky	(h)	Th	Gh				Eh			
ridged	(r)	Tr	Gr		Mr	Lr	Er		Or	Rr
veneer	(v)	Tv	Gv	Av	Mv	Lv	Ev	Cv	Ov	
terraced	(t)		Gt	At	Mt	Lt				Rt
eroded and dissected	(e)	Te	Ge		Me	Le		Ce		
kettled	(k)	Tk	Gk							Rk
deltaic	(f)		Gf	Af				Cf		
lineated	(l)	Tl					El		Ol	Rl
concealed by vegetation	(c)							Cc		Rc
weathered	(w)						Ew			Rw
complex	(x)	Tx	Gx		Mx	Lx				Rx
apron	(a)							Ca		

Bedrock mapping was completed for three 1:250,000 scale maps covering the field area.

AGGREGATE-RESOURCE SURVEYS

Mary's Harbour

Mary's Harbour (3D/5) is located on the southeastern end of the St. Lewis Inlet, approximately 325 km southeast of Goose Bay. The community is spread out over rolling barrens around a small inlet at the mouth of the St. Mary's River. The area is almost devoid of surficial material (Figure 5*). Outcrops of predominantly granitic gneiss, banded augen gneiss and massive granite appear in many places (Douglas and Hsu, 1968). A few small pockets of ballast were depleted during the construction of the Lodge Bay–Mary's Harbour road. A gravel deposit is located about 0.5 km to the north of the community. This gravel deposit, at sample site 83-3018 (Figure 6), is approximately 60 m long, 5 m wide and 2 m high, and contains approximately 600 m³ of material. It is a small deposit of quality aggregate, but the presence of a radio tower at this site prevents any extraction.

* The base maps for Figures 5 to 31 were taken directly from parts of several, 1:50,000 scale, NTS map sheets, and contain the conventional symbols for these standard topographic maps.

Table 7. Petrographic range of bedrock types in community areas

Communities	Petrographic range (variations based on weathering and mineral content)
Lodge Bay	0100 - 0600*
Mary's Harbour	0100 - 0600
Fox Harbour	0100 - 0300
Williams Harbour	0100
Port Hope Simpson	0100 - 0300
Charlottetown	0100
Paradise River	0100 - 0300
Cartwright	0100 - 0300
Black Tickle	0100 - 0600
Rigolet	0100 - 0600
Makkovik	0100 - 0100
Postville	0100 - 0300
Hopedale	0100 - 0300
Big Bay	0100 - 0300
Davis Inlet	0100
Nain	0100

* Petrographic Legend

Number	Classification
0100	Good
0300	Fair
0600	Poor
1000	Deleterious

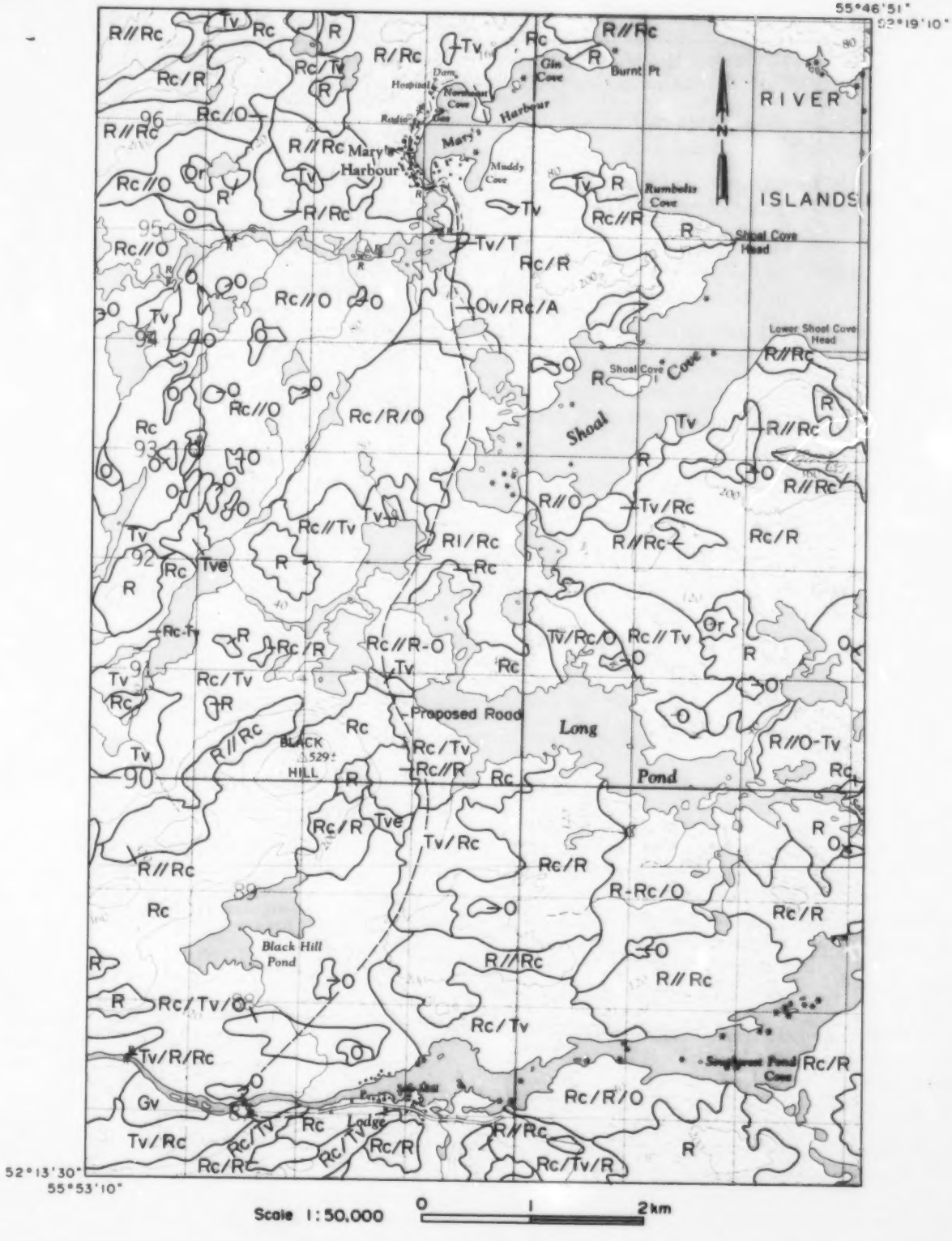

Figure 5: *Surficial-geology map for Lodge Bay and Mary's Harbour, 1:50,000 scale, 3D/4 and 3D/5 (see Table 6 for classification scheme).*

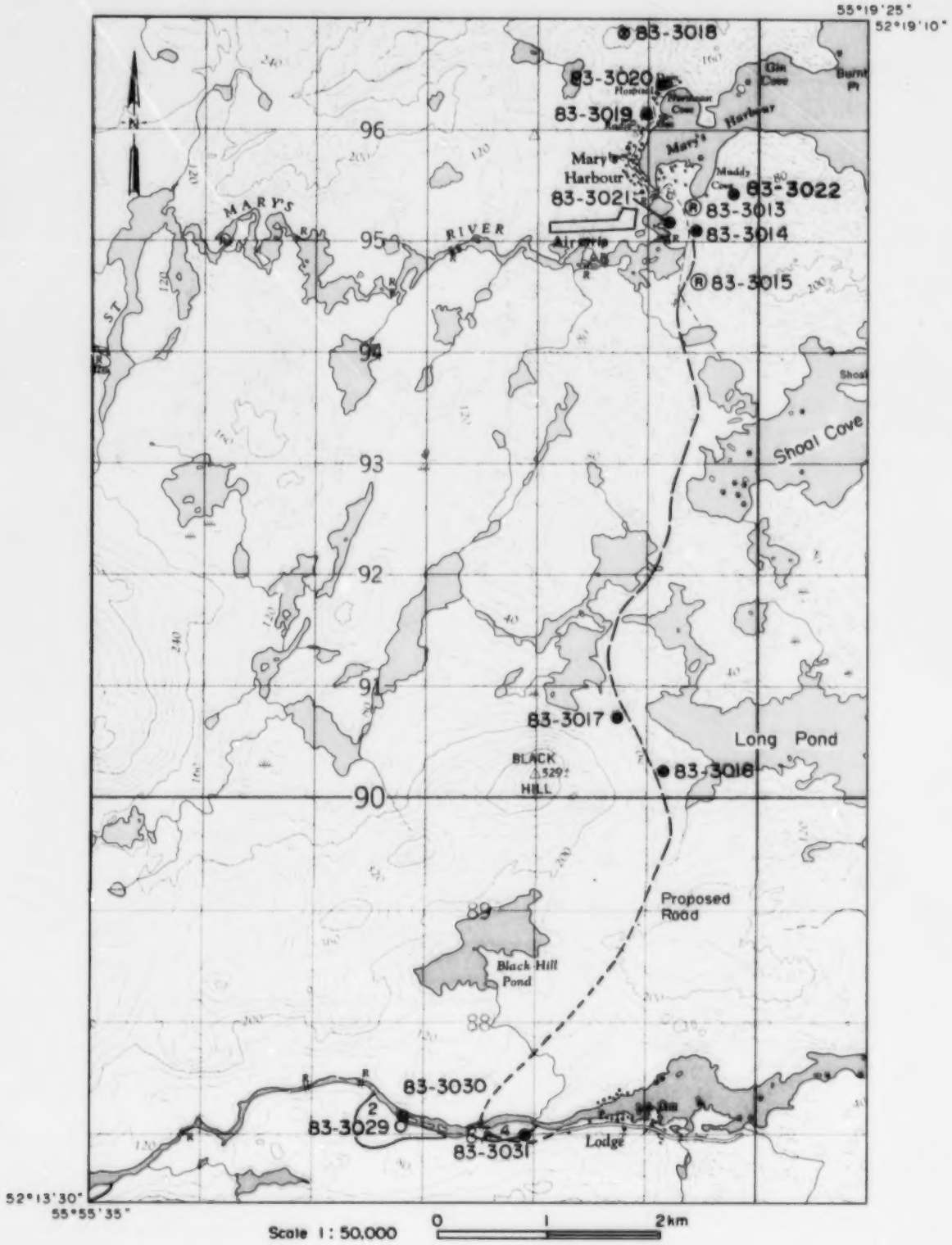

Figure 6: *Aggregate-resource map for Lodge Bay and Mary's Harbour, 1:50,000 scale, 3D/4 and 3D/5.*

LEGEND[1]

1 *Areas known to contain usable granular materials; probability of locating economic deposits is moderate to high; may include active or inactive pits and quarries*

Eskers – sinuous ridges of granular materials, moderate to high potential for locating economic deposits

1b *Areas known to contain granular materials of predominantly sand size; high potential for economic sand exploitation, low to moderate potential for other coarser granular type materials*

2 *Areas containing thin or discontinuous or nearly depleted usable granular materials; may also include areas where extent of thicker deposits could not be determined by field investigation; probability of locating usable deposits is moderate to low*

3 *Areas that may contain usable granular materials but deposits not substantiated by field investigation; probability of locating usable deposits is low to moderate*

4 *Areas of possible usable materials of nongranular composition, e.g., sandy tills, colluvial or weathered bedrock materials generally containing less than 10 to 15 percent silt/clay that may be beneficiated for higher grade uses*

NOTE: Classification criteria do not include conflicting land uses for routine purposes.

Sand or gravel pit (active, abandoned)

Borrow pit of low-quality material (active, abandoned)

Rock quarry (active, abandoned)

Sample locations (till, gravel, sand, silt, clay, organic and rock respectively)

83-3000 *Location of gravel sample No. 3000 taken in 1983 from an active gravel pit; sample location also denotes location of pit*

83-3029
83-3030 *Location of multiple samples from same site; shown in stratigraphic order*

Petrographic numbers of pebble samples collected in the Mary's Harbour area are generally low (Table 2), which indicate that the pebble fractions are suitable for most construction purposes.

Lodge Bay

Lodge Bay (3D/4) is located 8 km south of Mary's Harbour (Figure 6). It is situated along the St. Charles River, 9 km inland from a rugged coastline that is composed of many inlets and rocky cliffs. Lodge Bay is the most southerly community within the study area.

Lodge Bay is situated in an area of low-lying hills, and is geologically similar to the Mary's Harbour area, being underlain by granitic gneiss, banded augen gneiss and massive granite (Douglas and Hsu, 1968). Bedrock outcrops are common, although less so than in the area surrounding Mary's Harbour. Hilltops are generally barren and large surficial deposits are scarce in this region. A till hummock, located about 1 km west of the community along the St. Charles River, could provide adequate road material. Petrographic numbers for this approximately 45,000-m³ deposit are good (Table 2). A shallow sand deposit, located 1.5 km upstream from Lodge Bay, contains abundant iron oxide, which will limit its use for construction purposes.

Fox Harbour

Fox Harbour (3D/5) is situated on the northern side of St. Lewis Sound in a sheltered harbour approximately 335 km southeast of Goose Bay. It is underlain by paragneiss rich in mica, and minor quartz veins containing pyrite and chalcopyrite mineralization (Douglas and Hsu, 1968). The community is surrounded by a high rock ridge that has moderate tree growth along the lower west-facing slopes. A rolling landscape to the north and west is predominantly composed of low-lying rock ridges covered in places by a thin

[1] All aggregate-resource maps in this report refer to this legend; however, not all units and symbols apply to every map.

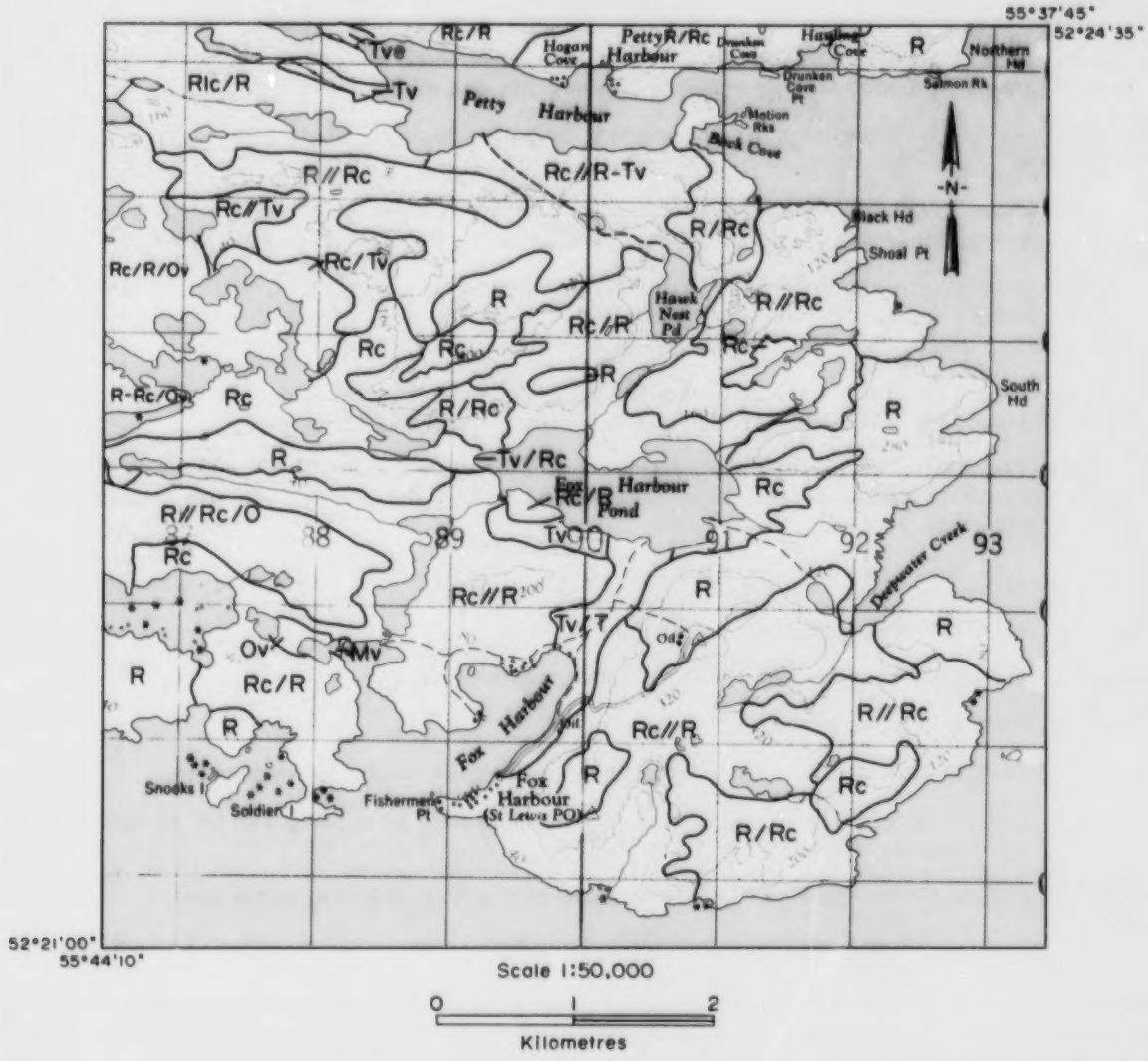

Figure 7: *Surficial-geology map for Fox Harbour, 1:50,000 scale, 3D/5 (see Table 6 for classification scheme).*

layer (less than 2 m) of surficial sediments (Figure 7). Stunted tree growth occupies the valleys and other low-lying areas. A large bogland is located in the valley between Fox Harbour Pond and Fox Harbour. The bog is surrounded on both sides by a deposit of silty-sandy till at the base of the valley cliffs. Aggregate samples from this deposit (Figure 8) indicate that certain sections may provide adequate road gravel, although its silty nature may make it susceptible to washouts and instability when wet. Deeper test-pitting and analyses would be required to determine the overall quality and quantity of this material. Preliminary estimates indicate this deposit contains approximately 200,000 m^3 of material.

Materials used in recent road construction in Fox Harbour were derived from crushed rock and a substantial stockpile of crushed material was remaining at the time of the study. This material was also used during the construction of an access road to the radio tower constructed in the community.

High petrographic numbers (Table 2) of pebble samples collected in Fox Harbour indicate that the granular material is generally of poor quality for concrete or other high-quality uses. It is recommended that material be shipped in from other areas, or crushed bedrock, if suitable, be used for any concrete construction projects in this area.

Williams Harbour

Williams Harbour (3D/12) is the smallest community within the study area. It is located on Granby Island in Gilbert Bay and situated approximately 320 km southeast of Goose Bay. Rock units in the area mainly consist of granite, granitoid

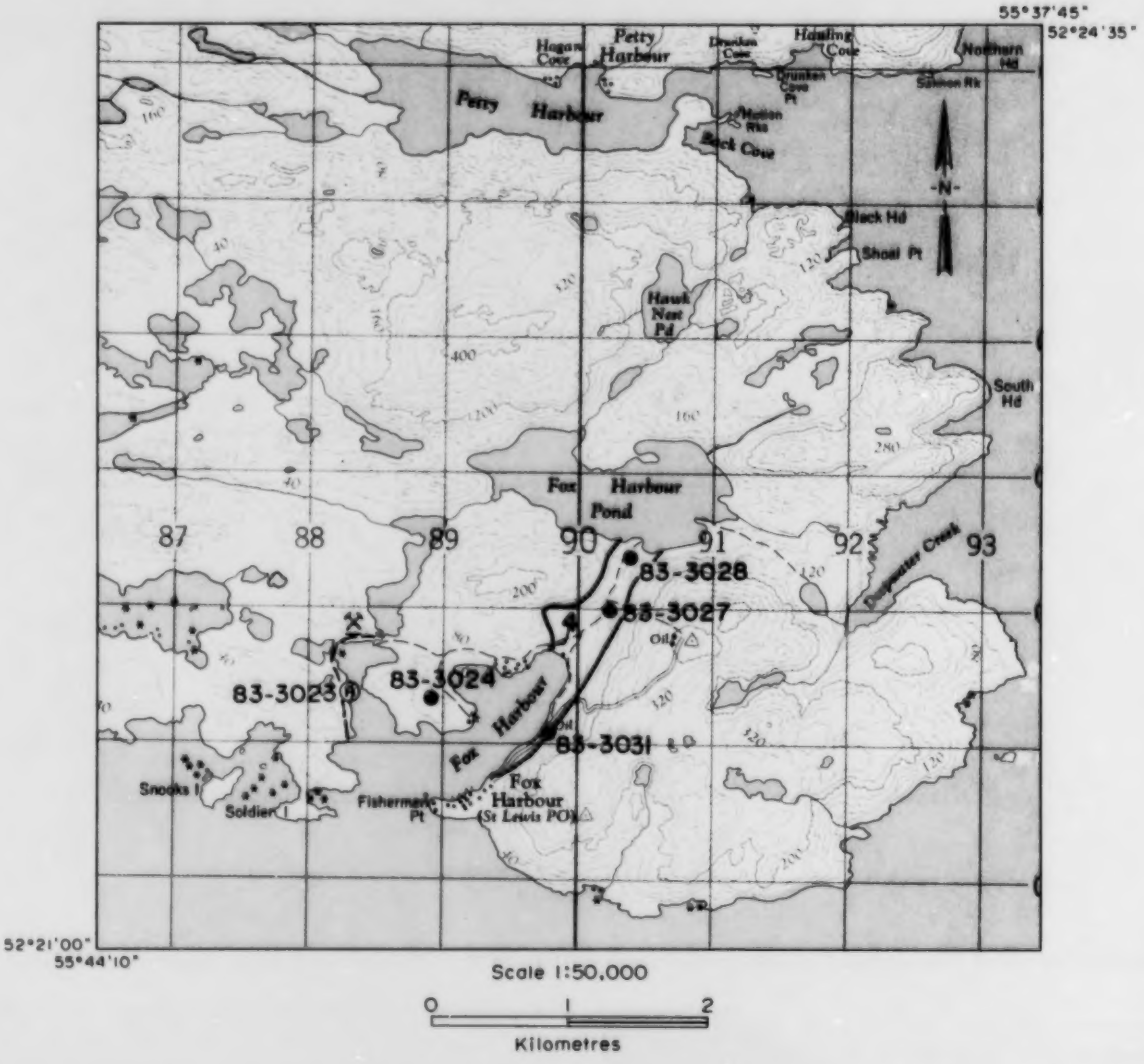

Figure 8: *Aggregate-resource map for Fox Harbour, 1:50,000 scale, 3D/5 (see Figure 6 for legend).*

gneiss and granitoids containing various amounts of undivided granite, monzonite, syenite, gabbro and pegmatite (Douglas and Hsu, 1968).

The most prominent surficial deposit (Figure 9) on Granby Island is a marine terrace in the Williams Harbour area, which has an estimated 940,000 m³ of material. This deposit (Plate 1) is approximately 700 m long and 300 m wide, with generally good petrographic numbers (Table 2). It contains gravel suitable for road construction as well as small amounts of sand suitable for concrete or mortar purposes. Its size, low petrographic numbers, and gravel and sand content give it a zone 1 potential (Figure 10). The marine-terrace deposit is the only quality aggregate material located on Granby Island, and because of its value to the construction needs of the community, it is recommended that it be zoned and reserved for extraction to prevent encroachment by other community developments. The only other aggregate deposit in the area consists of a compacted till having a high silt content, which might be used as a source of ballast or fill materials. A hardpan layer composed of iron oxide overlies the marine and till deposits. The hardpan is compacted, commonly greater than 1 m thick in places, and it is difficult to penetrate without the aid of heavy equipment. At the time of this study, the construction of a road between Williams Harbour and Georges Cove was underway. This provided fresh exposures and aided sampling, although the underlying deposits were locally compacted.

Port Hope Simpson

Port Hope Simpson (13A/9) is situated near the mouth of Black Water Brook on the south shore of the Alexis River.

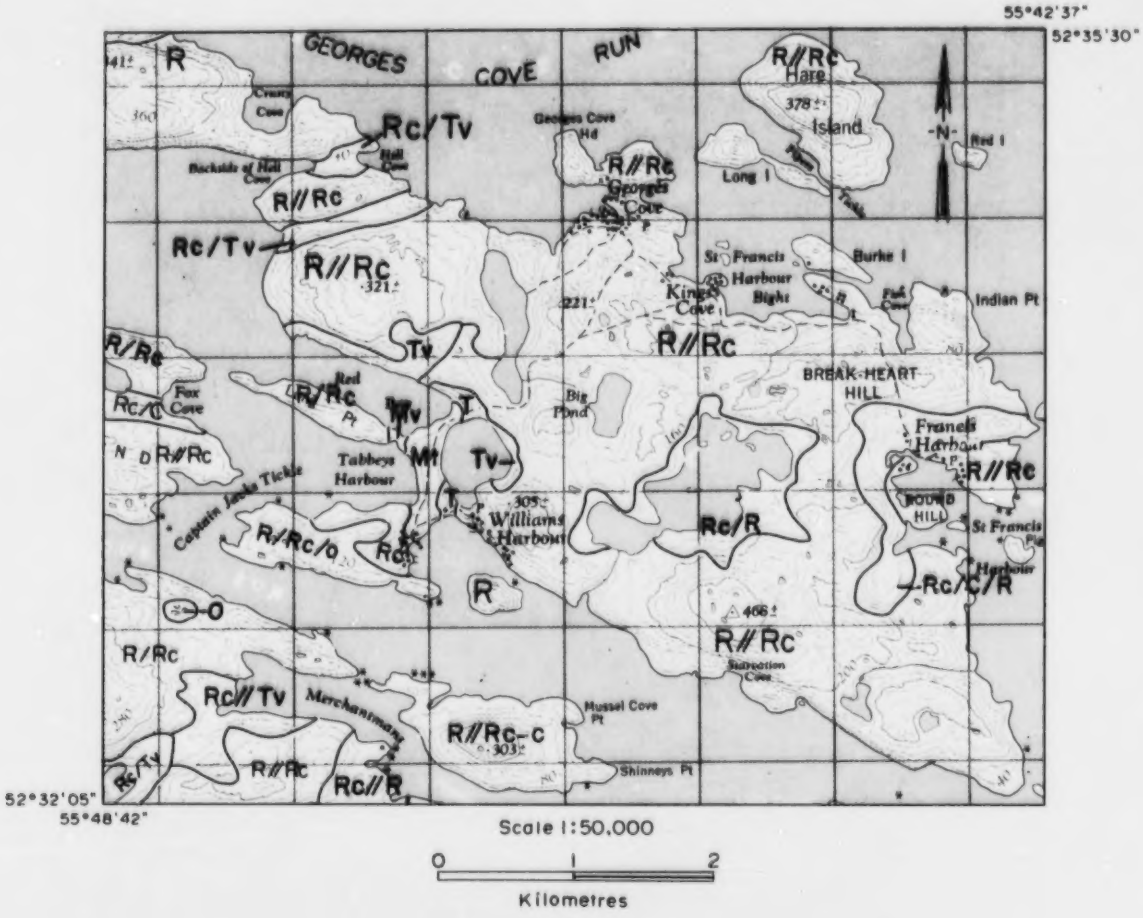

Figure 9: *Surficial-geology map for Williams Harbour, 1:50,000 scale, 3D/12 (see Table 6 for classification scheme).*

Plate 1: *Five-metre gravel exposure along road cut through marine terrace at Williams Harbour.*

It is approximately 40 km upstream from the open water of the Labrador Sea and is 290 km southeast of Goose Bay. The predominant rock types consist of granite, granitic gneiss, granitoids and minor amounts of amphibolite, anorthosite and limestone. Paragneiss and minor quartz veins containing pyrite and chalcopyrite mineralization also occur in this area (Douglas and Hsu, 1968).

The community is located in an area of dense spruce-tree growth; an extensive burnt-over area occurs approximately 1 km southwest of the community. It is well protected from strong continental winds by a large mountain ridge to the northwest that reaches over 88 m a.s.l. (above sea level). A ridge to the south is over 64 m in elevation and another to the northeast, across the Alexis River, has an elevation greater than 64 m.

Surficial deposits in a 6-km radius around Port Hope Simpsom are composed primarily of shallow, sandy silty tills

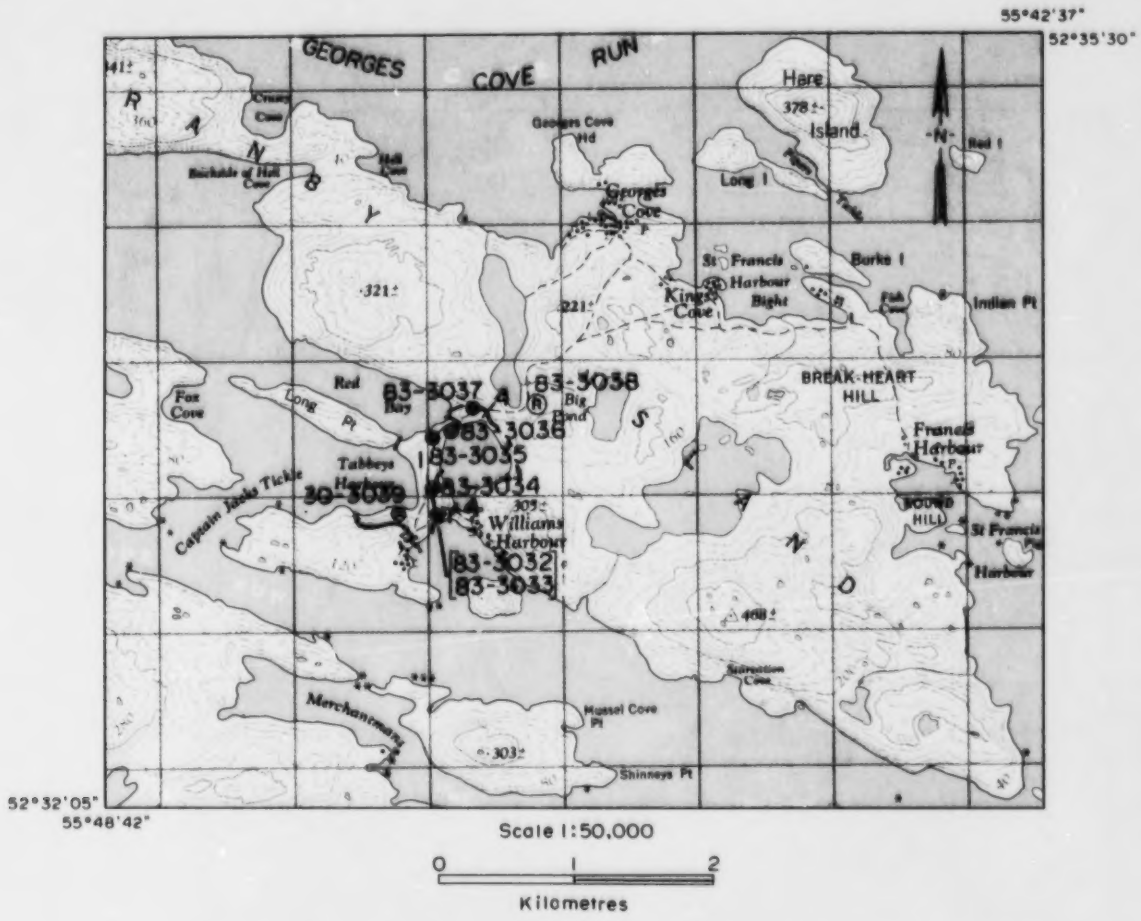

Figure 10: *Aggregate-resource map for Williams Harbour, 1:50,000 scale, 3D/12 (see Figure 6 for legend).*

(Figure 11). The high silt content in this material makes it unsuitable for most construction purposes, but it may be suitable for ballast material if worked when dry. A narrow sandy-till deposit located approximately 7 km upstream from the community along the Alexis River can supply potentially good road gravel. This deposit can be approached to within 1 km along forest access roads. These roads have remained in fair condition without upgrading since the closure of the logging industry about 20 years ago. A large gravel deposit (containing approximately 2,000,000 m³ of material), 1000 m long, 500 m wide and having a high boulder content, is located at the mouth of Bobbys Brook approximately 9 km west of Port Hope Simpson on the Alexis River (Figure 12). This deposit does not appear to be within hauling distance of the community and a 3-km-long road would have to be constructed to reach it. Petrographic numbers of pebble samples collected in the Port Hope Simpson area are less than 300, again indicating moderate-to-high-quality material suitable for most construction purposes.

Charlottetown

Charlottetown (13A/16) is located in a well protected harbour on the south shore of White Bear Arm approximately 285 km from Goose Bay. The community is strung out along a coastal strip in St. Michael's Bay.

The dominant rock types consist of anorthosite, gabbro, granitic gneiss and minor amounts of amphibolite (Douglas and Hsu, 1968). The community is surrounded by forested hills with rock outcrops at the peaks. Surficial deposits consist of sandy-silty tills and one small glaciofluvial terrace (Figure 13).

An abandoned borrow pit (Plate 2) is located within the sandy-silty tills at the northern edge of the community (sample site 83-3054, Figure 14). This deposit can supply ballast material and adequate road gravel. However, construction of a new playground began over the deposit in 1983. It is recommended that consideration be given to relocating the

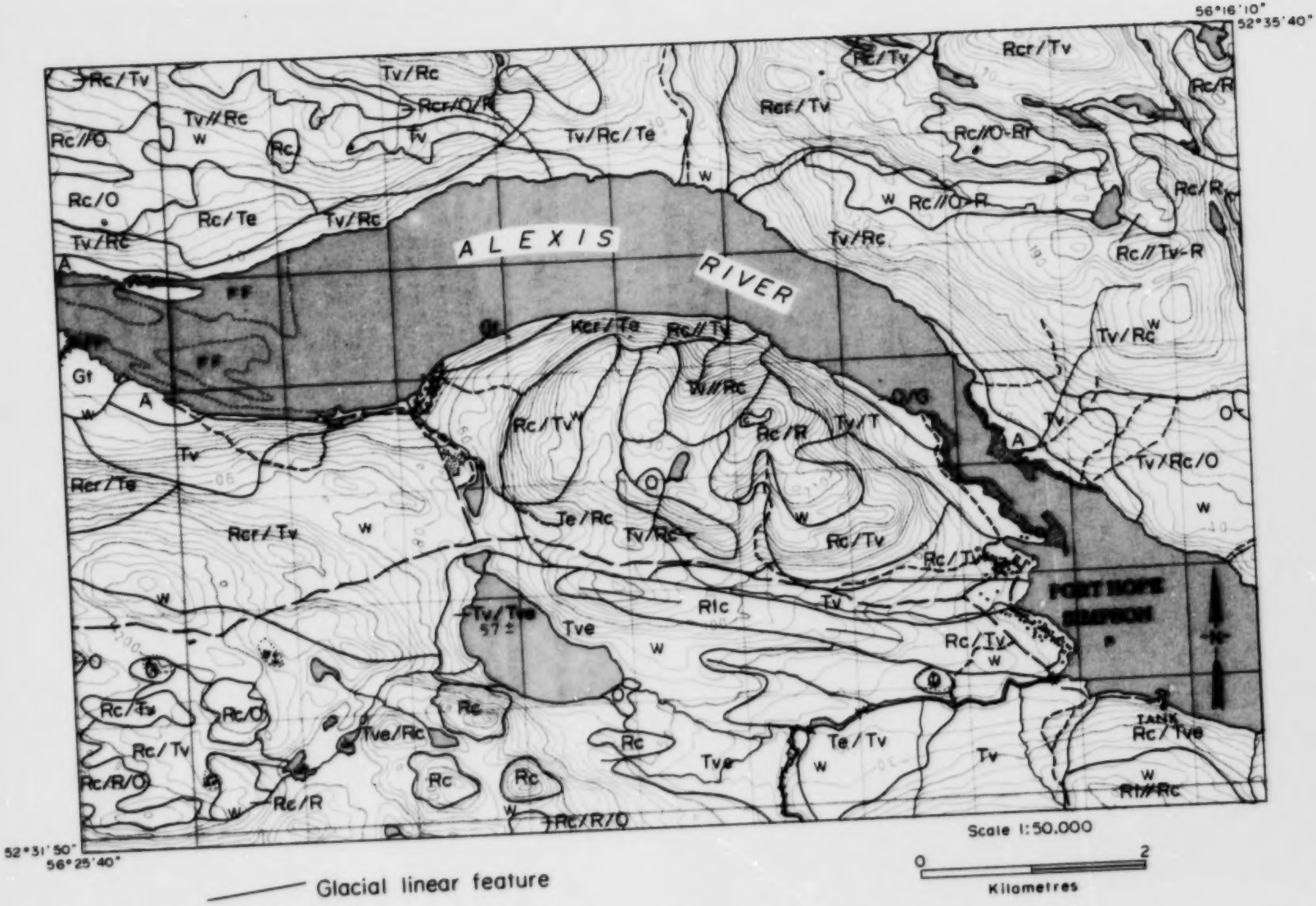

Figure 11: *Surficial-geology map for Port Hope Simpson, 1:50,000 scale, 13A/9 (see Table 6 for classification scheme).*

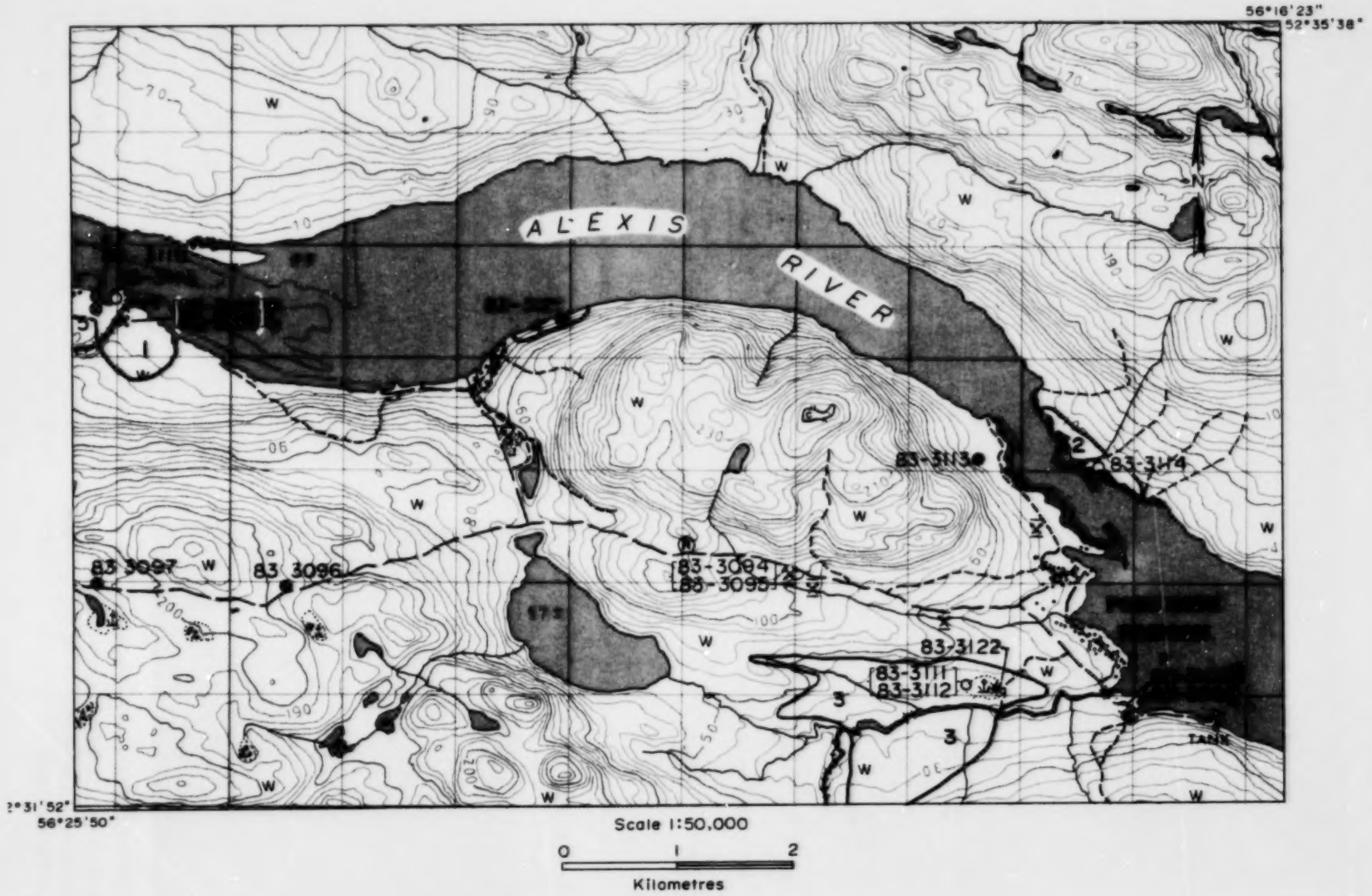

Figure 12: *Aggregate-resource map for Port Hope Simpson, 1:50,000 scale, 13A/9 (see Figure 6 for legend).*

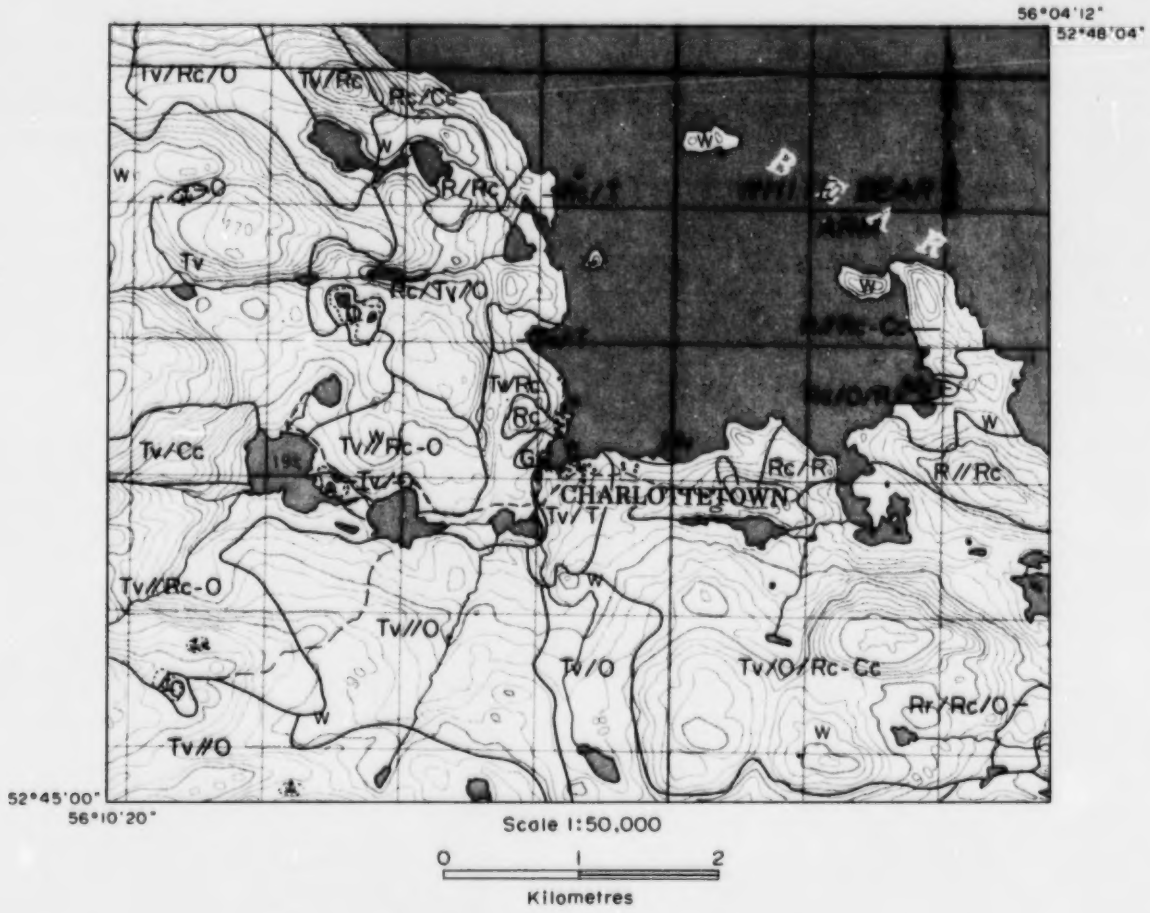

Figure 13: *Surficial-geology map for Charlottetown, 1:50,000 scale, 13A/16 (see Table 6 for classification scheme).*

Plate 2: *Abandoned borrow pit it Charlottetown.*

playground to ensure adequate materials are available to meet future demand; there is little prospect of locating another deposit so near the community.

A glaciofluvial terrace (Plate 3), approximately 100 m long, 20 m wide and 3 m high, was also sampled in Charlottetown. It is primarily composed of medium to coarse grained sands containing approximately 25 percent pebble content. Nearby community housing will likely prevent extraction from this location. If extraction is permitted, however, the deposit is large enough to supply the higher quality aggregate used in small concrete projects. All petrographic numbers of pebble samples collected in Charlottetown were less than 300.

Paradise River

The community of Paradise River (13H/6) is located at the southern end of Sandwich Bay near the mouth of the Paradise River. It is approximately 210 km east of Goose Bay and is situated along a narrow strip of shoreline nearly 2 km in length. The physical setting is characterized by dense tree growth and barren hilltops, with extensive areas of bogland to the southeast of the community.

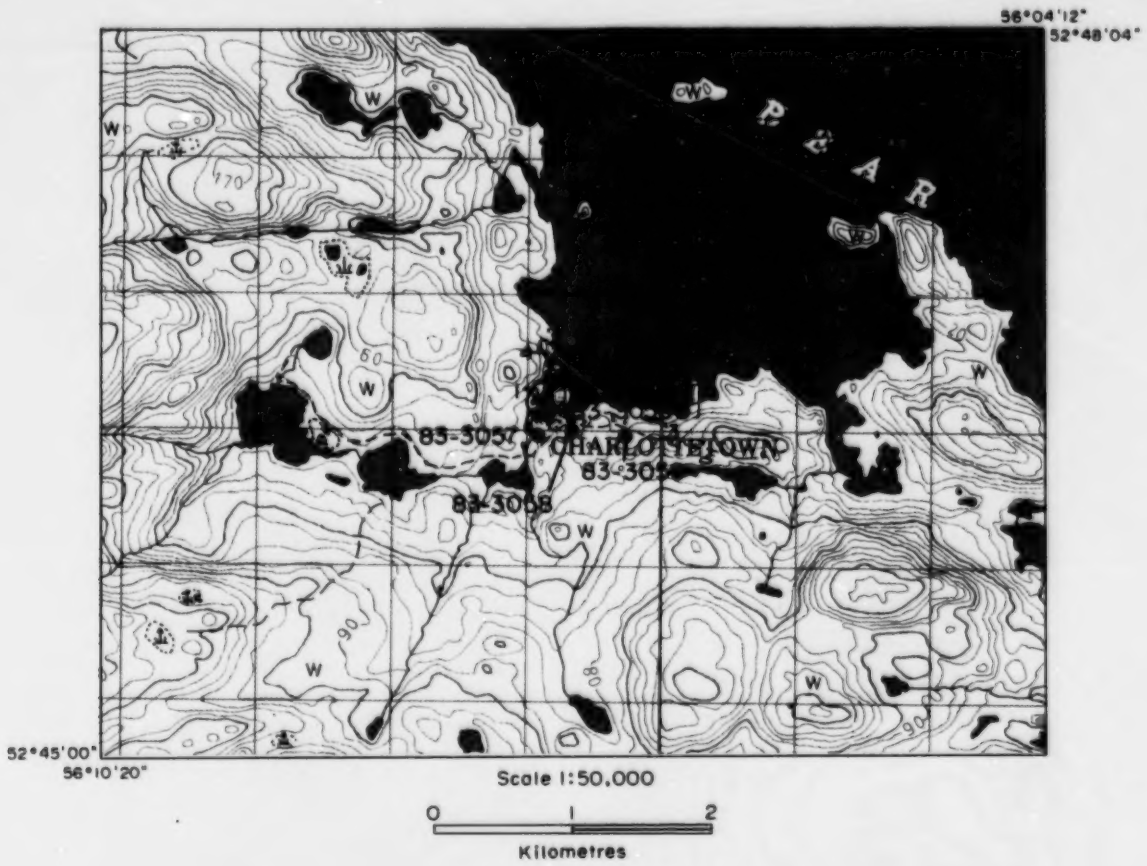

Figure 14: *Aggregate-resource map for Charlottetown, 1:50,000 scale, 13A/16 (see Figure 6 or legend).*

Plate 3: *One-and-one-half-metre gravel exposure in glaciofluvial terrace at Charlottetown.*

Bedrock predominently consists of granitic gneiss, banded gneiss and locally occurring granite, and granitoids (Douglas and Hsu, 1968). Surficial deposits (Figure 15) are comprosed of till. Aggregate samples collected in this area (Figure 16) have a substantial silt – clay content. The poor quality of these deposits make them unsuitable for aggregate extraction. They can only be used as fill or ballast, provided they are extracted and emplaced when dry. These deposits did not contain any significant amount of pebbles, therefore no petrographic analyses were conducted.

The only means of acquiring suitable aggregate in this community is to bring in heavy equipment to crush bedrock or to ship aggregates in from other areas.

Cartwright

Cartwright (13H/11) is situated around a spacious, well sheltered harbour on the northeast side of Sandwich Bay, approximately 230 km east of Goose Bay. It occupies a flat to gently rolling landscape, and hills, reaching elevations greater than 150 m a.s.l, surround much of the community.

The bedrock geology is similar to that of Paradise River. Rock units predominently consist of granitic gneiss, banded gneiss and locally occurring granite, and granitoids (Douglas and Hsu, 1968). Surficial deposits (Figure 17) include

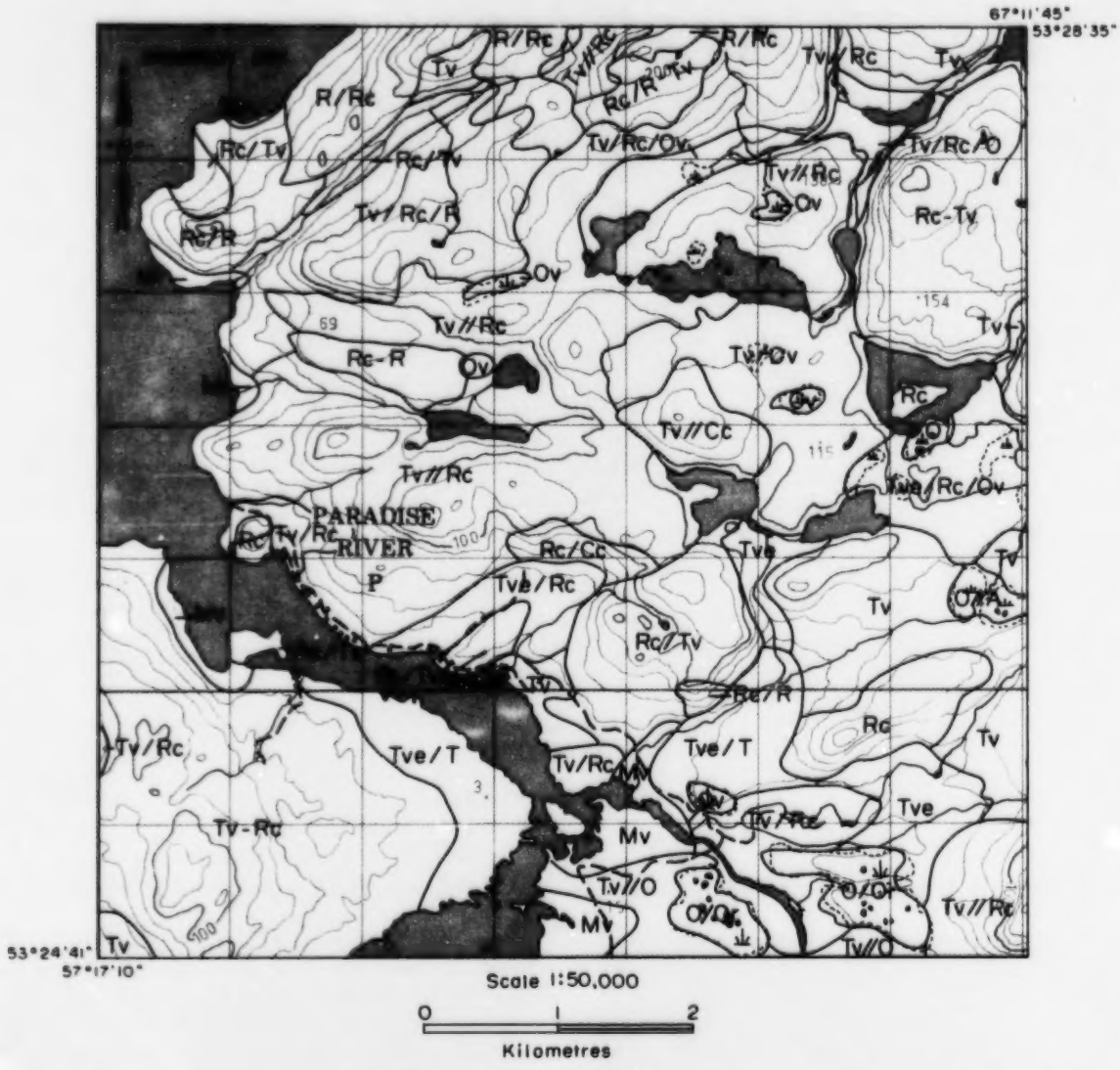

Figure 15: *Surficial-geology map for Paradise River, 1:50,000 scale, 13H/6 (see Table 6 for classification scheme).*

granular materials of marine origin, which underlie much of the community. A substantial deposit of coarse granular marine material is located in the northwest part of the community. However, the presence of houses, a graveyard and radio towers has sterilized this deposit, preventing extraction. Some of the shallower deposits located on the hill slopes near the central part of the harbour are nearing depletion. There are several gravel pits located in the north–central part of the community, where shallow deposits were mined to provide material for a water and sewer project. A small glaciofluvial terrace (Plate 4) was sampled in the area of the water supply, west of the community. This material could provide excellent road gravel but extraction must be carefully regulated due to the proximity of the water reservoir. Under proper guidelines, extraction could be permitted in this area.

Bedrock exposures are located in the northern part of the community and along the route of the municipal water supply to the south. Material for use in construction of an airstrip in 1981 was derived from crushed bedrock at sample site 83-3126 (Figure 18), located approximately 3 km to the south–southeast of the community.

A large organic plain, approximately 600 m by 350 m, is located to the north, near the central part of the community. Organic deposits are also dominant to the south of the community near the nursing station, as well as on the way to the airstrip.

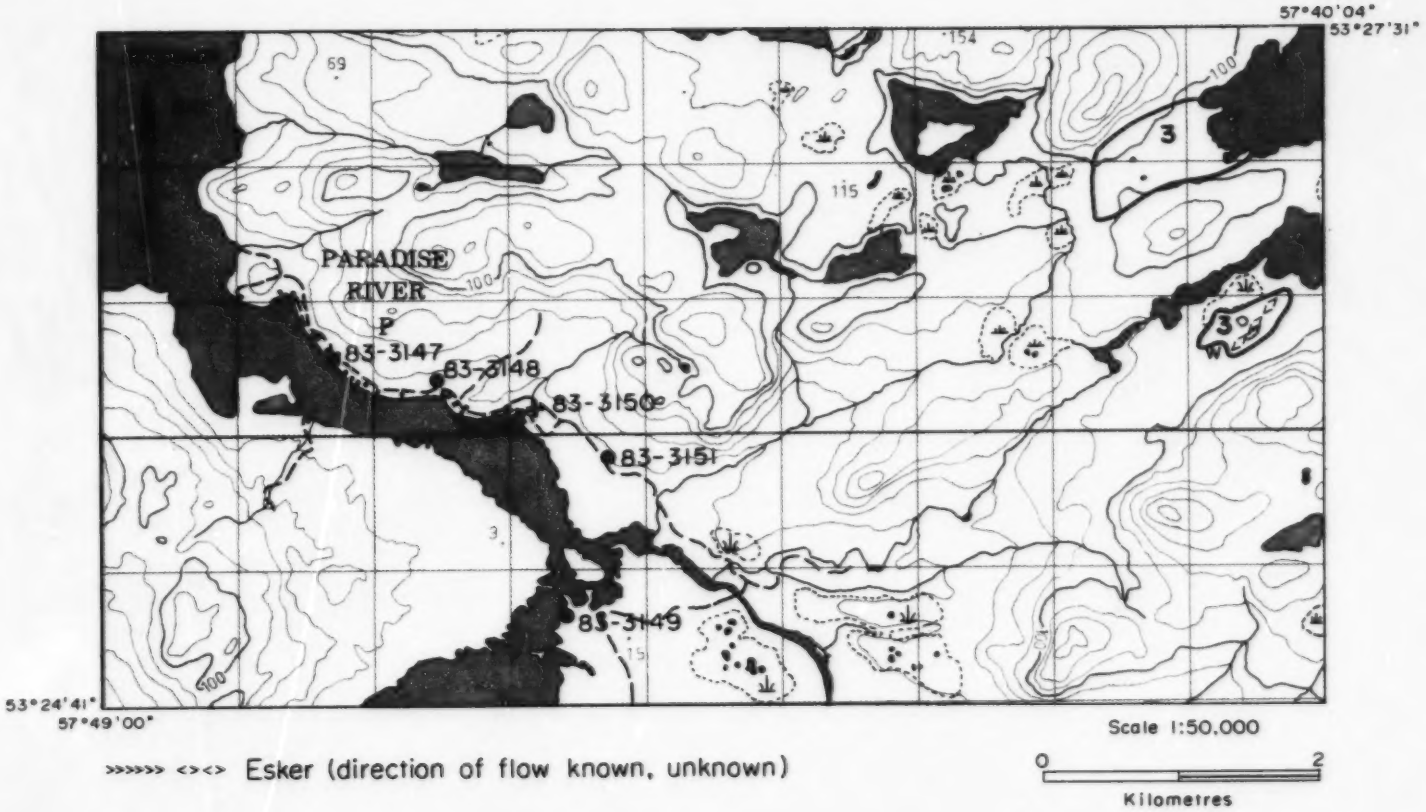

Figure 16: *Aggregate-resource map for Paradise River, 1:50,000 scale, 13H/6 (see Figure 6 for legend).*

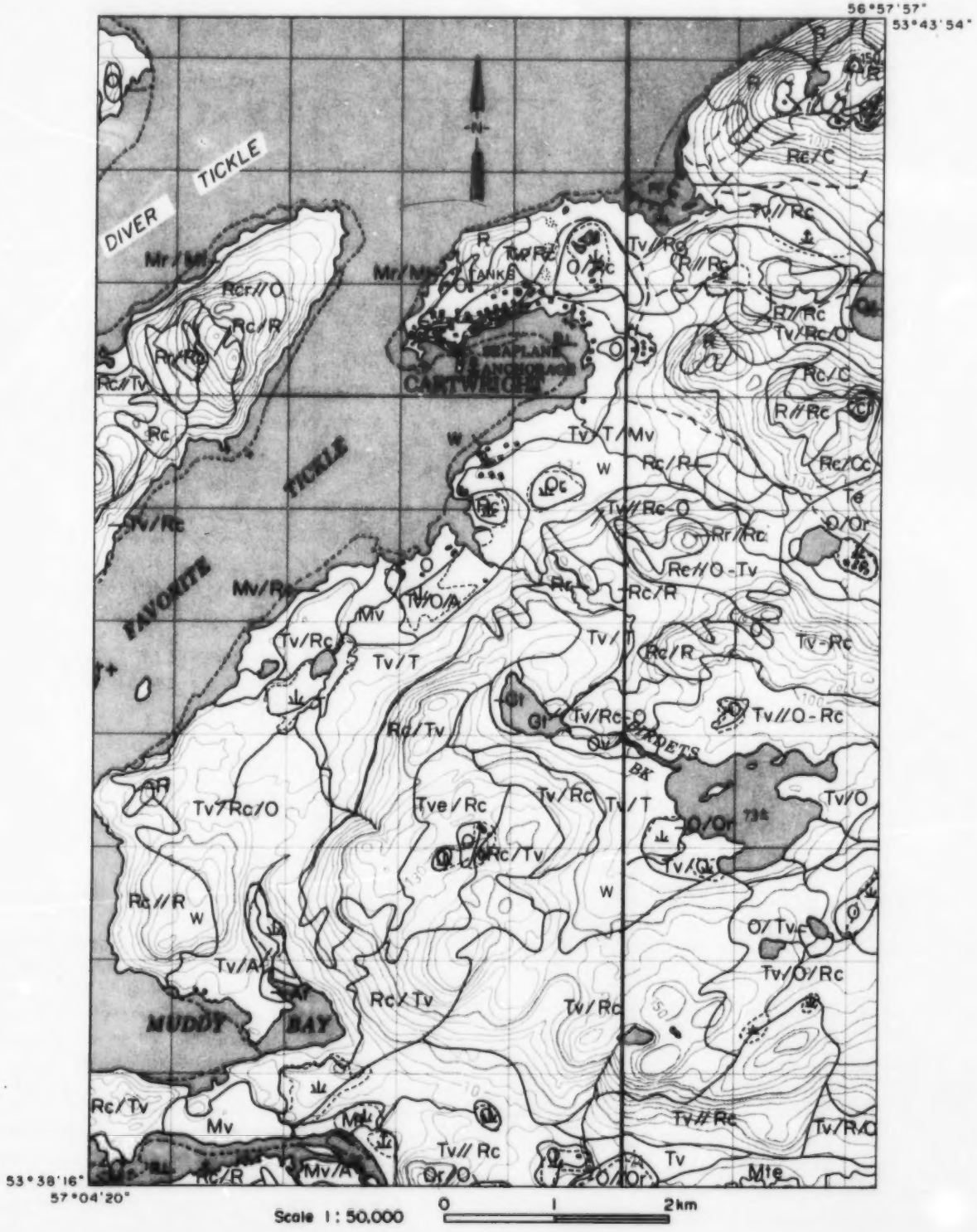

Figure 17: *Surficial-geology map for Cartwright, 1:50,000 scale, 13H/10 and 13H/11 (see Table 6 for classification scheme).*

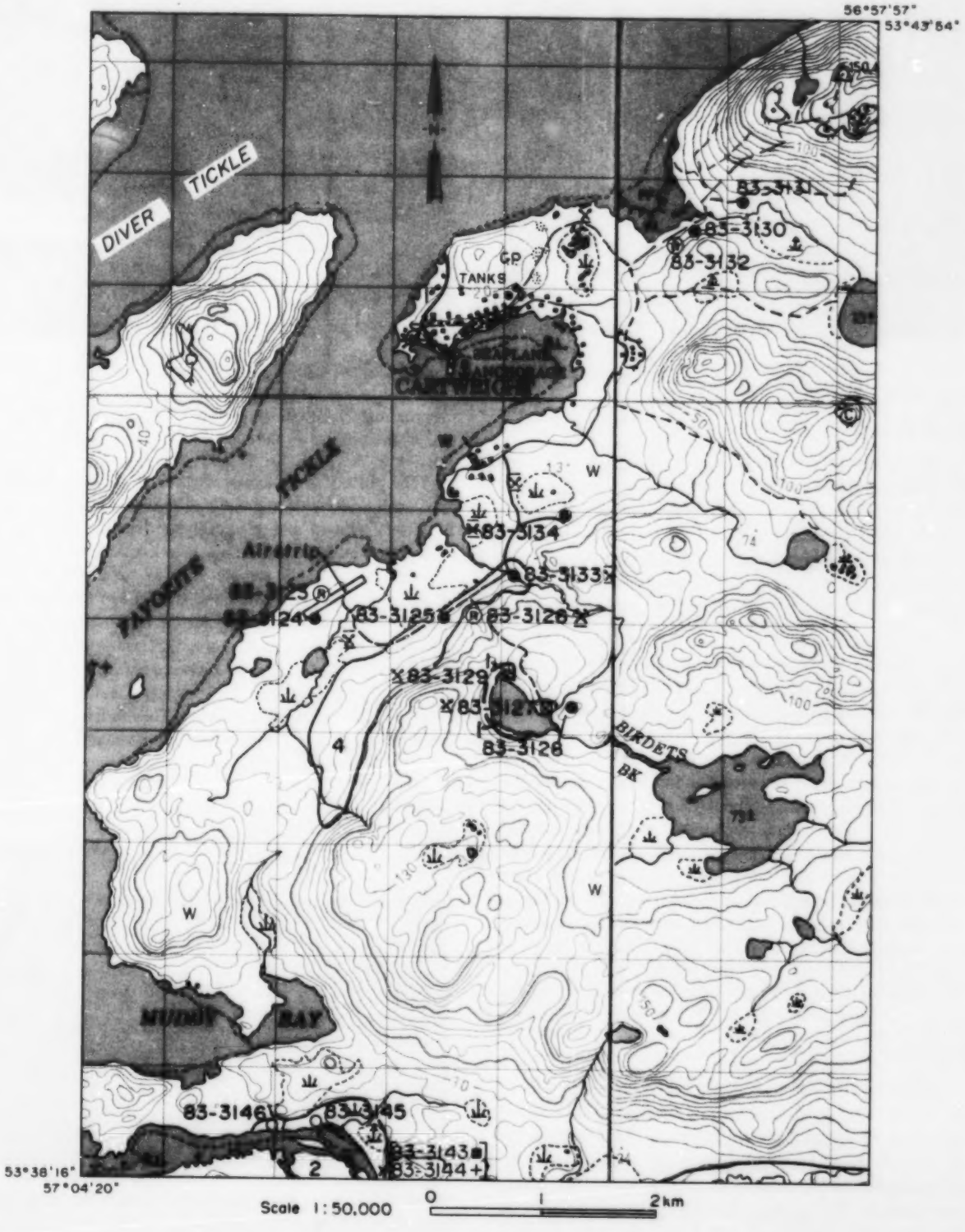

Figure 18: *Aggregate-resource map for Cartwright, 1:50,000 scale, 13H/10 and 13H/11 (see Figure 6 for legend).*

Plate 4: *Abandoned gravel pit in glaciofluvial terrace at Cartwright.*

Plate 5: *Sand quarry at Black Tickle.*

Black Tickle

Black Tickle (3E/5) is situated in a sheltered harbour at the eastern end of the Island of Ponds, approximately 305 km east of Goose Bay. The island is dominated by exposed bedrock although there are numerous shallow ponds; bog, moss and low bush growth occur in the more protected areas of the island. Black Tickle itself is surrounded by exposed rocky hills, some reaching elevations greater than 60 m a.s.l.

The Black Tickle area is underlain by granitic gneiss, banded gneiss and locally occurring granite, and granodiorite (Douglas and Hsu, 1968). Surficial units primarily consist of a thin till veneer and exposed bedrock (Figure 19). The only large overburden deposit, approximately 700 m in length and 100 m wide, is located at sample site 83-3159 (Figure 20) in a narrow valley between Salmon Bight and Domino Harbour, and is overlain by about 0.5 m of bog. This deposit (Plate 5) is of poor quality, containing mostly sand and silt, and was not zoned as an aggregate extraction area. A high petrographic number of 730 and the presence of iron oxide indicate that this material is unsuitable for most construction purposes. Higher quality beach materials were once available in small quantities, but these have been exhausted. For most construction purposes, aggregate material will have to be derived from crushing of bedrock, or materials must be shipped in from other areas.

Rigolet

Rigolet (13J/1) was the most northern community studied during the 1983 field season. It is situated in a sheltered harbour at the entrance to Lake Melville, approximately 160 km east of Goose Bay. The community is protected from strong continental winds by a rock ridge to the north, approximately 270 m a.s.l., and another ridge to the southwest that is approximately 115 m a.s.l. A large bogland (approximately 500 m by 1000 m) is located at the western end of the airstrip to the west of the community.

The bedrock units consist of granite, amphibolite gneiss, and locally occuring migmatite (Douglas and Hsu, 1968). Extensive marine and glaciofluvial deposits are present around the Rigolet area (Figure 21). A deposit to the southwest of the community, at sample sites 83-3206 and 83-3207 (Figure 22), consisting of a dominant sandy pebble texture, was quarried to provide gravel for the local roads (Plate 6). This deposit has a good petrographic number of 176. Other granular deposits include gravels of marine origin; these are generally located between the rock slope and the shoreline along the road to the existing quarry. The marine gravels have been mined to a small degree but are not suitable aggregates because the deposit is thin and contains many boulders.

Plate 6: *Sandy pebble gravel in abandoned quarry in glaciofluvial terrace at Rigolet.*

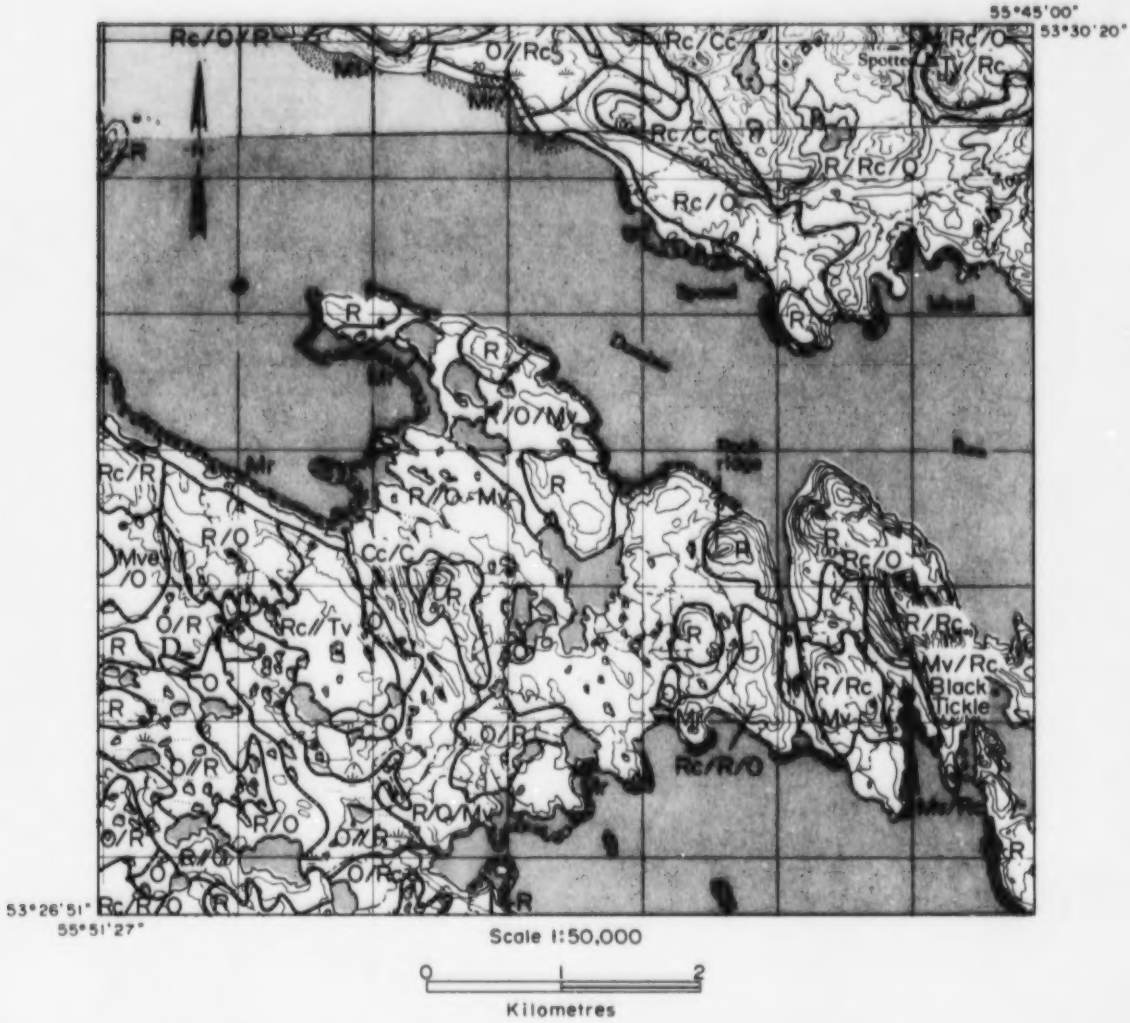

Figure 19: *Surficial-geology map for Black Tickle, 1:50,000 scale, 3E/5 (see Table 6 for classification scheme).*

A till deposit to the west of the community has a very high silt content. This material is very unstable when wet, and hard and compact when dry.

It is recommended that the zone 1 aggregate deposit (Figure 22) be included within the community municipal plan to prevent other developments from occurring in this area. Larger gravel and sand deposits exist across the channel, but it will become much more expensive to use these in construction projects because of haulage costs.

RECONNAISSANCE AGGREGATE SURVEYS

Introduction

In 1984, two days of reconnaissance aggregate surveys were conducted in the coastal communities of Postville, Hopedale, Big Bay (possible relocation site for Hopedale), Davis Inlet and Nain.

Due to the short period of time for field work, only 10 aggregate samples were collected for particle-size analyses, and aggregate mapping was restricted to the community areas. Preliminary surficial mapping was completed for a 10-to-12-km radius around each community area. There were no pebble lithologic studies or bedrock-aggregate mapping conducted in these areas.

For informational purposes, data collected during the inventory of Aggregate Resources in the community of Makkovik in 1980 are also included in this report. This will, at least, provide some general aggregate information on all permanent coastal communities north of Lodge Bay.

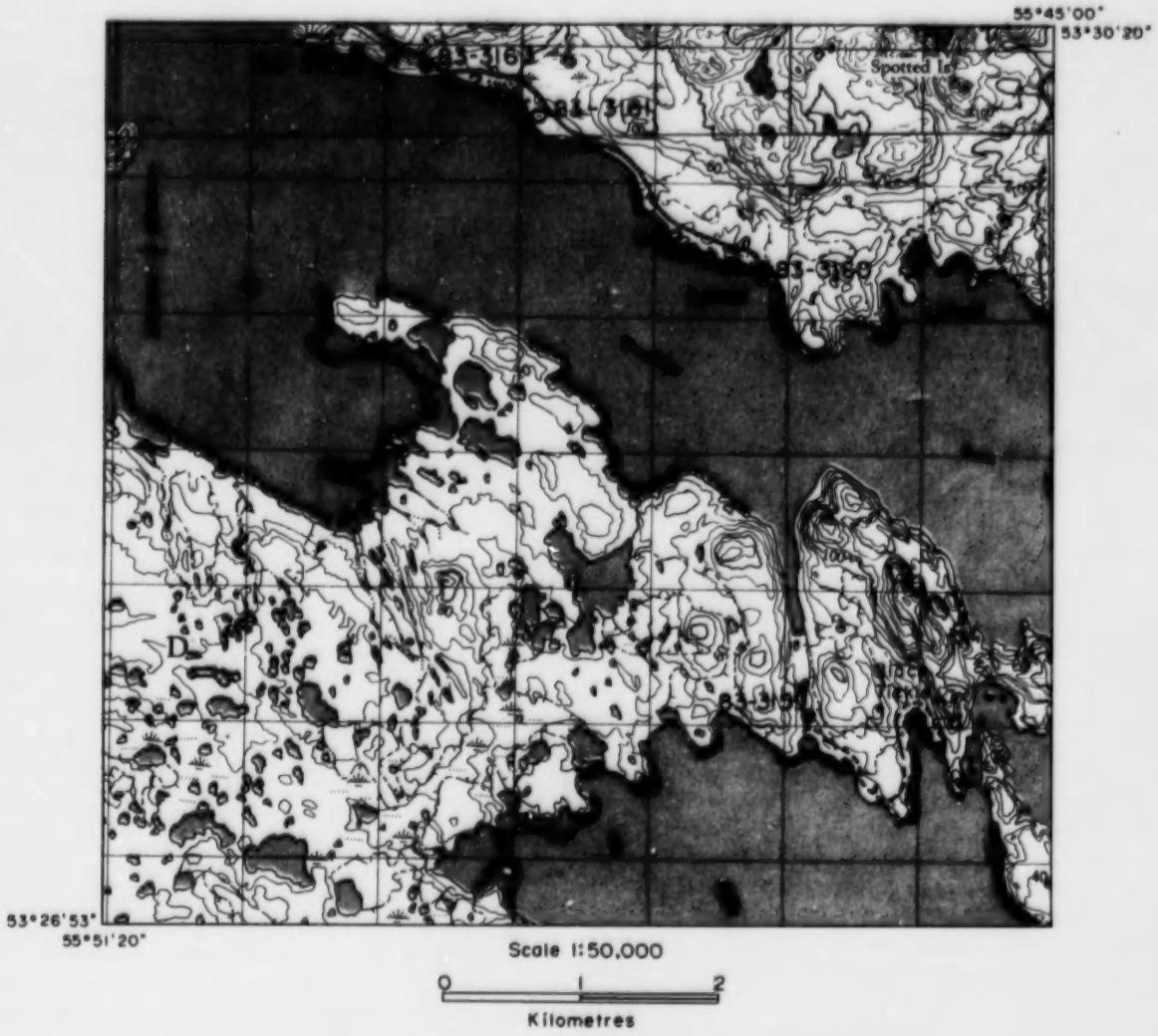

Figure 20: *Aggregate-resource map for Black Tickle, 1:50,000 scale, 3E/5 (see Figure 6 for legend).*

Due to lack of detailed information, coloured maps (1:250,000 scale) were not prepared for these areas. Page-size maps at 1:50,000 scale are included in this report, showing the currently available aggregate information. Information collected in these areas is outlined in the community review.

Makkovik

Makkovik (130/3) is located in Makkovik Bay and is situated along a coastal strip of land 1.5 km long on the western side of Makkovik Harbour, approximately 210 km north of Goose Bay. Rock units consist of feldspathic quartzite, conglomerate, argillite, basic volcanic rocks, and metamorphic equivalents of the Aillik Group (Greene, 1970).

The geographical setting of Makkovik is characterized by rock outcrops and thin layers of till in barren areas to the east of the community. The central part is composed of silty tills resulting in poor drainage, whereas to the north, the community is characterized by thick tree growth and rock slopes. Surficial-geology interpretation (Figure 23) indicates the area around Makkovik to be composed of concealed rock, exposed bedrock and minor till veneer. Large deposits of marine material are also located in areas around the community.

During 1980, granular deposits of gravel, sand and clay were sampled in the region around Makkovik (Figure 24). A deposit west of the community, in Ranger Bight, contains gravel deposits 20 to 30 m in thickness. An existing quarry has a working area that is approximately 100 m by 100 m by 10 m high. The dominant texture changes from cobble to boulder gravel at the top, to gravel and sand below. This

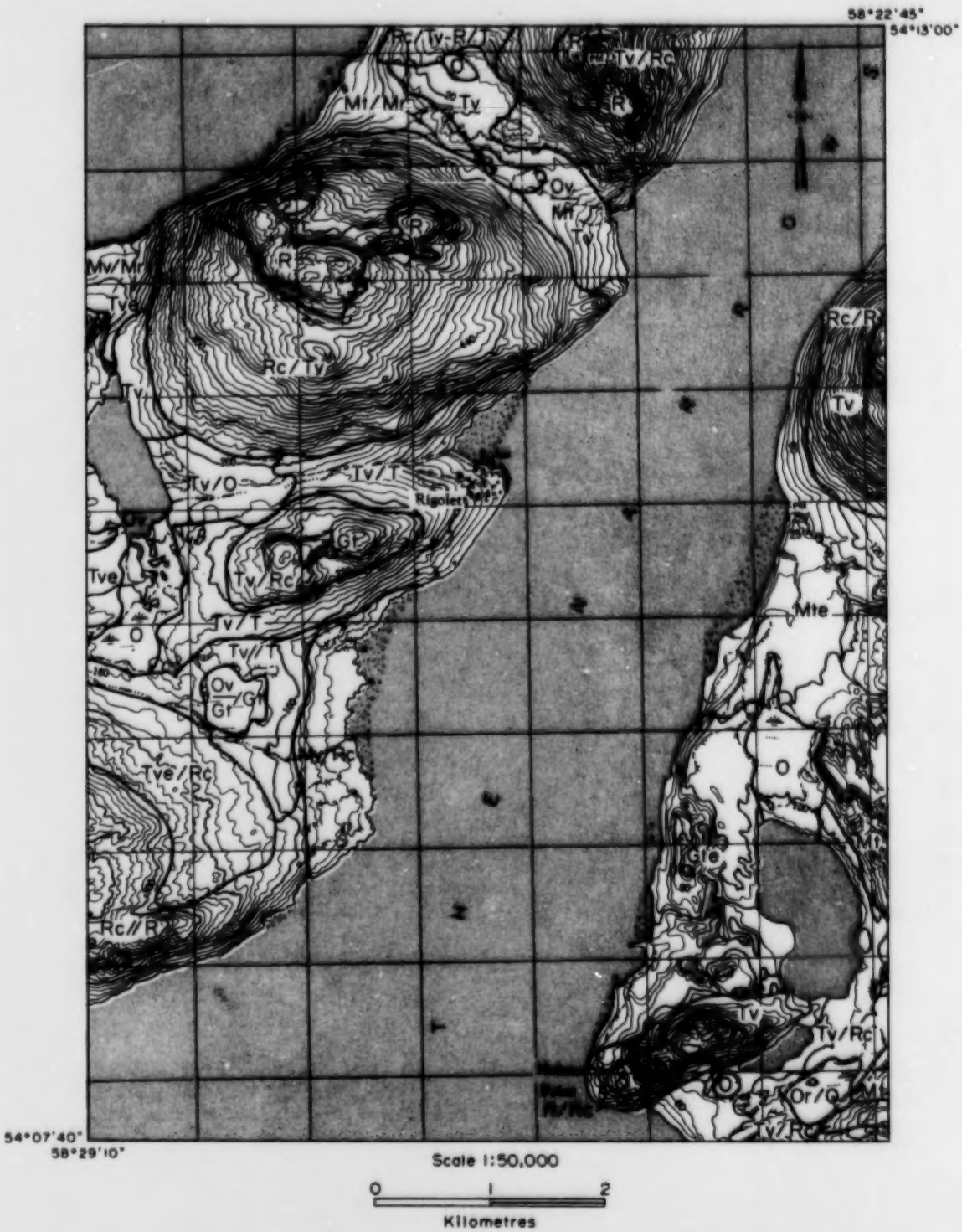

Figure 21: *Surficial-geology map for Rigolet, 1:50,000 scale, 13J/1 (see Table 6 for classification scheme).*

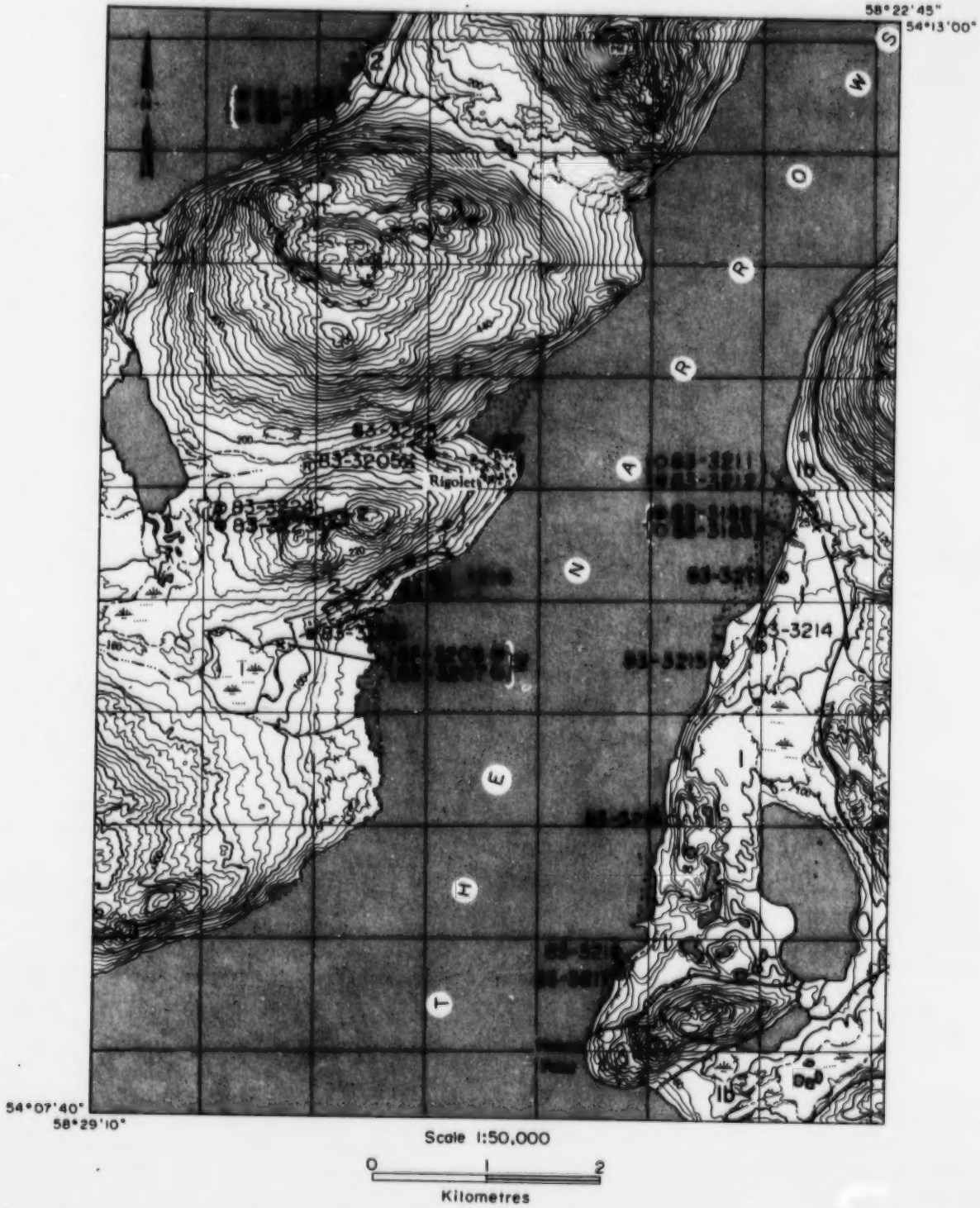

Figure 22: *Aggregate-resource map for Rigolet, 1:50,000 scale, 13J/1 (see Figure 6 for legend).*

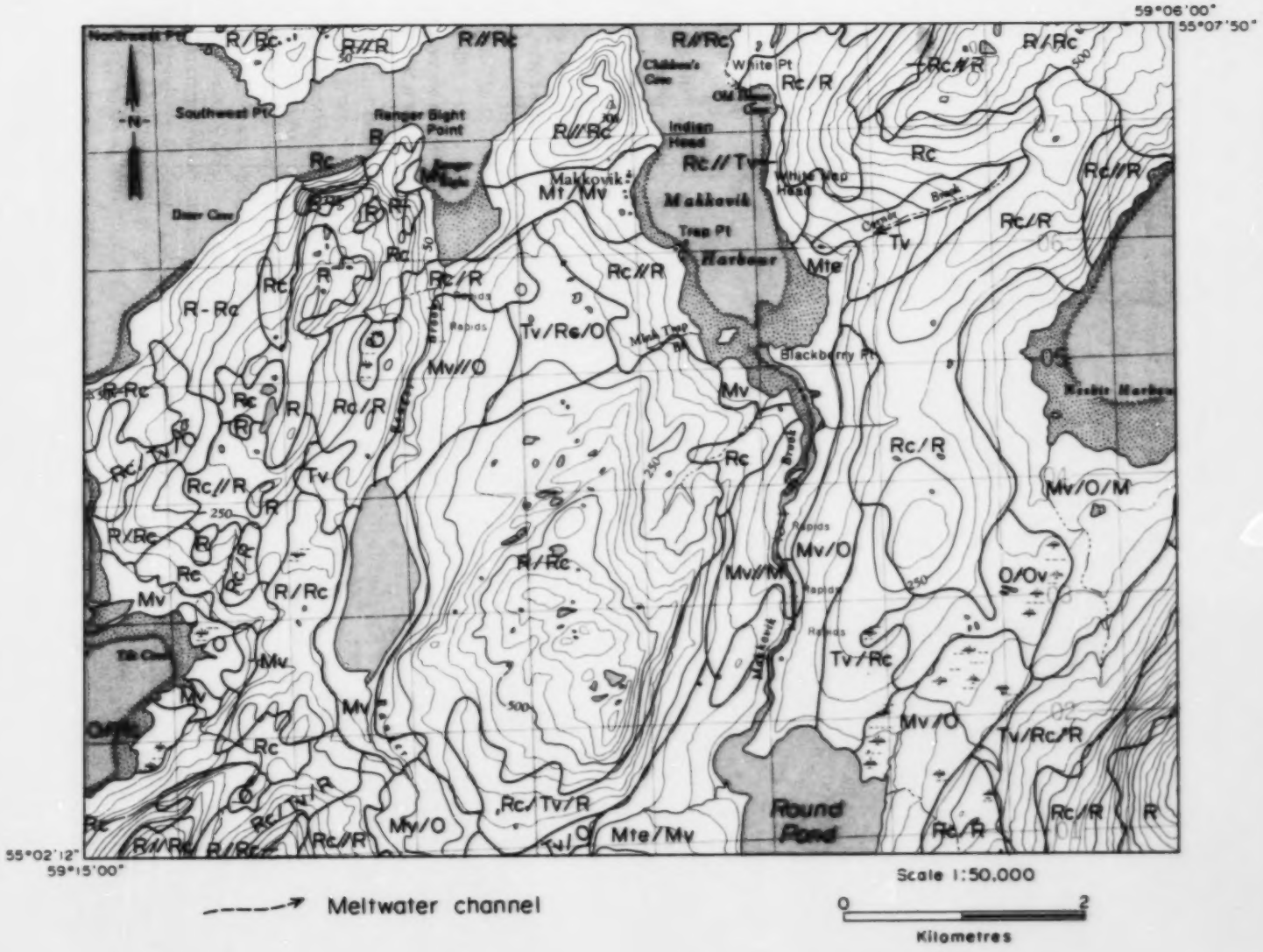

Figure 23: *Surficial-geology map for Makkovik, 1:50,000 scale, 130/3 (see Table 6 for classification scheme).*

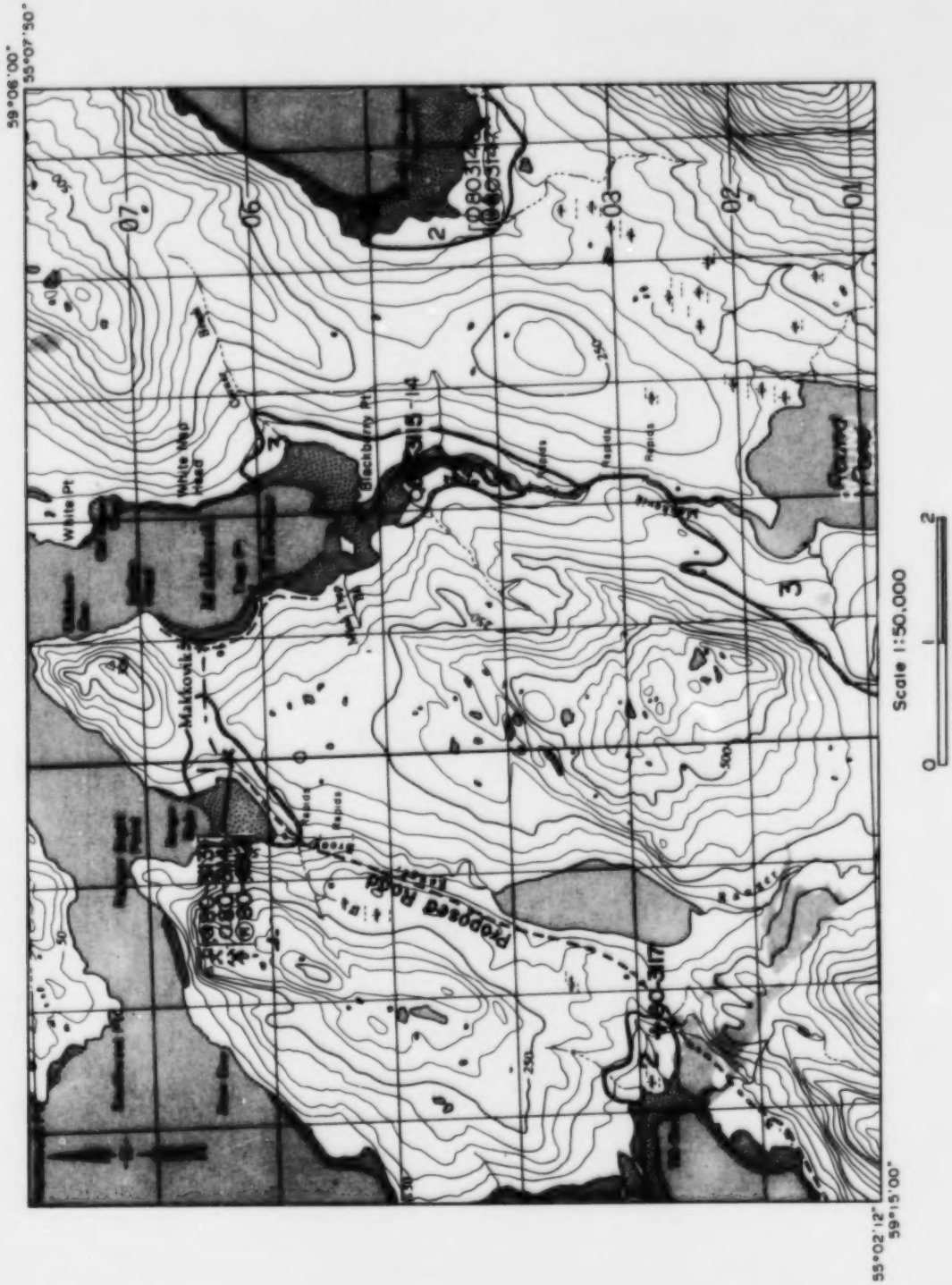

Figure 24: *Aggregate-resource map for Makkovik, 1:50,000 scale, 13O/3 (see Figure 6 for legend).*

deposit is estimated to be over 1.5 km long and 0.2 to 0.5 km wide, with total reserves of approximately 6,000,000 m³.

Another granular deposit is located on the west side of Makkovik Brook, near its mouth at the entrance to Makkovik Harbour. This deposit is predominantly composed of fine to medium grained sand and is overlain by 1 m of sandy–cobbly gravel. The deposit has a 4-m-thick exposure at sample site 80-3147, and is estimated to contain 700,000 m³ of aggregate material.

Other aggregate deposits, such as those at Tilt Cove, the east bank of Makkovik River, and Nesbit Harbour, contain larger reserves than those at Ranger Bight and the west bank of the Makkovik River, but are less suitable because they contain sand, silt and clay, and are located in areas where access is a problem.

It is recommended that the deposit in Ranger Bight (zone 1, Figure 24) be zoned as an aggregate quarry area in the community municipal plan. This deposit has a petrographic number of 357, suggesting limited use in concrete. It should, however, supply material of a suitable quality for road gravel.

Postville

Postville (13J/13) is situated on the north shore of Kaipokok Bay, approximately 180 km north of Goose Bay. The topographical setting is characterized by gently sloping land bounded by a low ridge (approximately 120 m in elevation at its highest point) to the southwest and a valley to the north. Wide stretches of bogland occur in a west-southwest direction from Kaipokok Bay. The community is located in an area of till veneer, up to 1 m thick, and exposed bedrock (Figure 25). There is sparce-to-moderate-density tree cover and low shrubs. The area is underlain by granite, granodioritic gneiss, migmatite, granulite, amphibolite, minor paragneiss and metasedimentary rocks (Greene, 1970).

A deltaic deposit within the community is composed of stratified gravel and sand (Plate 7). It will supply local demand for many years, although approximately 40 percent of the deposit was mined during construction of the airstrip. The deposit contains various grades of material ranging from silty sand and sand, to sandy or cobbly gravel. It is the only known accessible deposit of high-quality aggregate within or near the community (Figure 26). There are, however, some large deposits on the eastern side of Kaipokok Bay accessible only by boat or barge. There would be increases in the cost of the aggregate to local residents should these have to be accessed.

It is recommended that the deltaic deposit be zoned for quarry extraction in the municipal plan, and other developments restricted in this area. The area can be rezoned for other community needs after the deposit is depleted.

Plate 7: *Stratified sand and gravel in deltaic deposit in abandoned quarry at Postville.*

Hopedale

Hopedale (13N/8) is situated on a rocky peninsula of coastal Labrador approximately 240 km north of Goose Bay, where it is constantly subjected to northwest winds.

Hopedale is devoid of most surficial material, having only enough soil in cracks and hollows of the rock to allow for small shrub and bush growth in some places. Exposed bedrock is the dominant landform (Figure 27). Hopedale is surrounded on three sides by rock slopes and is located in a similar geological terrain as Postville, being underlain by granite, granodioritic gneiss, migmatite, granulite, amphibolite, minor paragneiss and metasedimentary rocks (Greene, 1970). There is little available flat land for community expansion. Water and sewage projects or airstrip-construction projects would be expensive because bedrock would have to be blasted. All granular materials would have to be produced by blasting and crushing. One shallow till deposit (Plate 8) near the community is approximately 20 m long, 10 m wide and 3 m high. However, it is of poor quality, containing many boulders and a high concentration of iron oxide. This material is currently being used for fill. Any community developments or housing will require that aggregate construction materials be brought in, or allowance made to have bedrock blasted and crushed.

Big Bay

In view of local interest to relocate the community of Hopedale, a reconnaissance aggregate survey was carried out

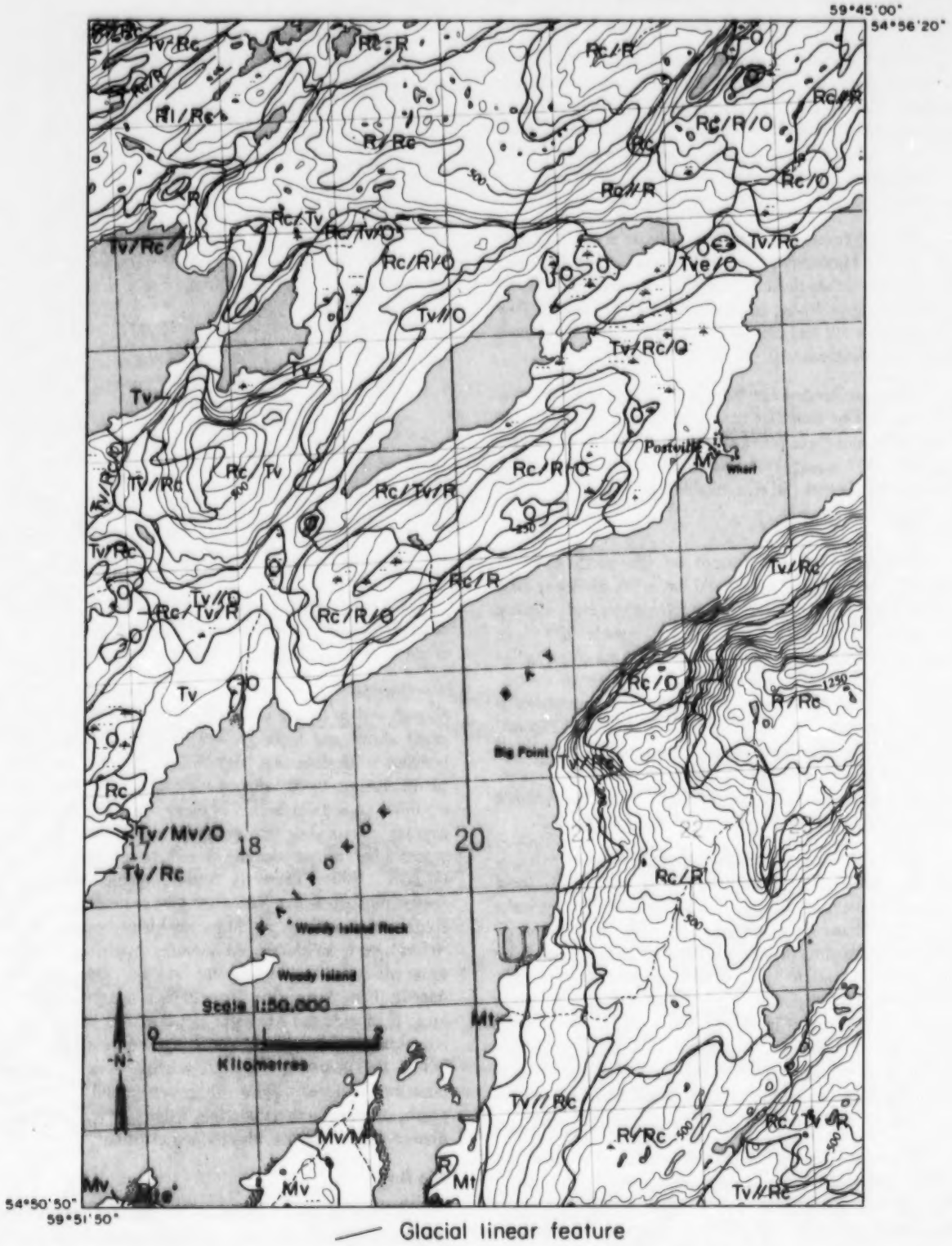

Figure 25: *Surficial-geology map for Postville, 1:50,000 scale, 13J/13 (see Table 6 for classification scheme).*

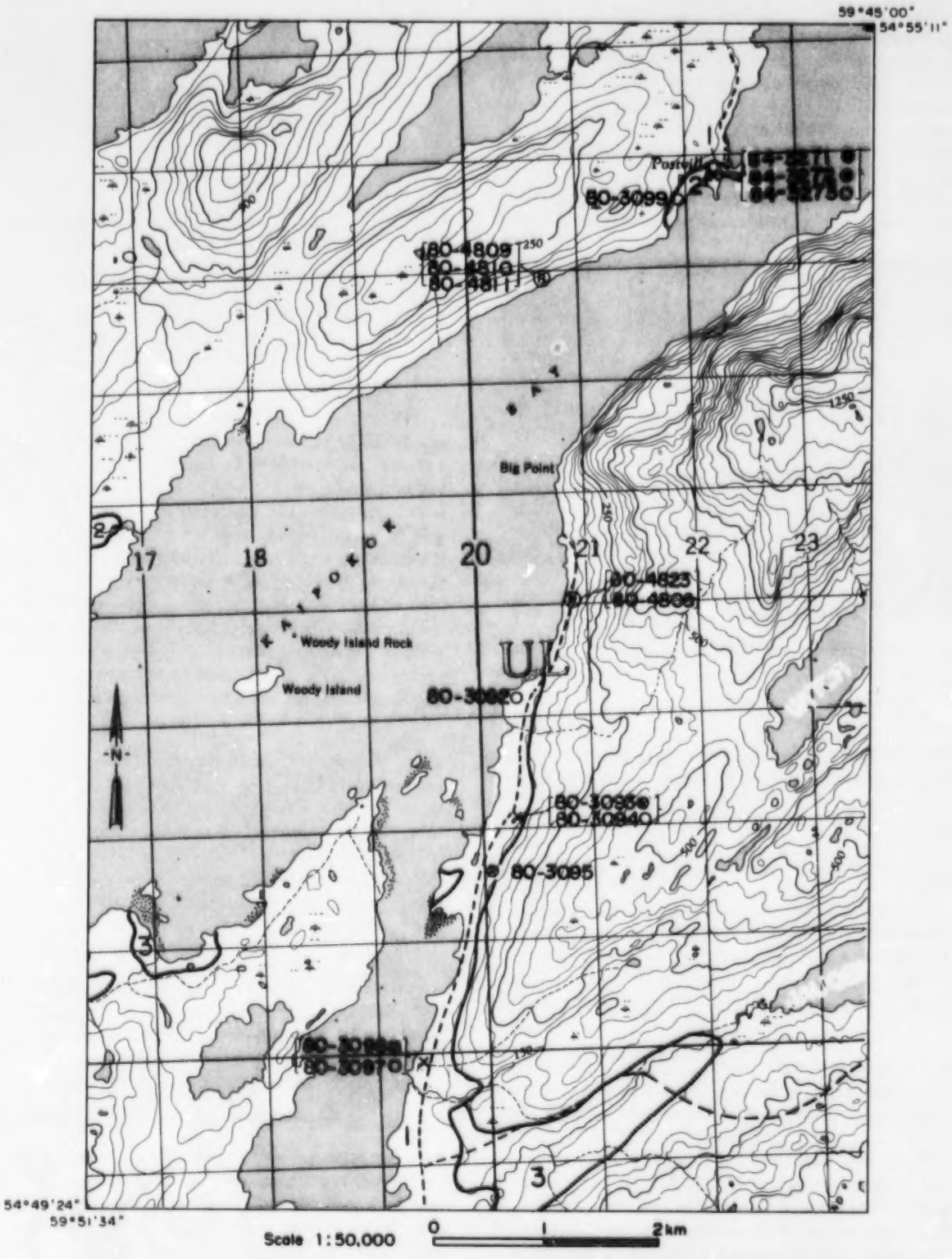

Figure 26: *Aggregate-resource map for Postville, 1:50,000 scale, 13J/13 (see Figure 6 for legend).*

Figure 27: *Surficial-geology map for Hopedale, 1:50,000 scale, 13N/8 (see Table 6 for classification scheme).*

Plate 8: *Shallow till deposit near Hopedale.*

in the Big Bay area (13N/10). The entrance to Big Bay is located approximately 42 km north of Hopedale. The bay, located at the mouth of Hunt River, is over 25 km long and has shallow areas extending 20 to 30 m offshore in most places. There is a high percentage of flat or gently sloping land on both sides of the bay, and dense forest growth covers most areas near the shoreline. A few large bogs (some over 2 km in length) occur on the eastern side of the bay. Mountain peaks on both sides reach elevations greater than 200 m a.s.l. Hunt River, flowing northeast into Big Bay, is a popular sports-fishing area for salmon. Two fish-camps were in operation along the river during the 1984 salmon-fishing season.

Surficial-geology interpretation (Figure 28) and a reconnaissance aggregate study have shown that the area contains large deposits of glaciofluvial outwash material. A possible raised marine beach (10 to 12 m a.s.l.) was sampled on the eastern side of the bay. Two samples (Figure 29) indicate sandy and sandy–cobbly gravel textures. Rock units consist of granite and granodioritic gneiss, migmatite, granulite, amphibolite, minor paragneiss and metasedimentary rocks (Greene, 1970).

If Hopedale is relocated here, there appears to be adequate granular resources for construction purposes. The nature of the unconsolidated overburden should make servicing (e.g., roads, water and sewer lines) relatively easy and comparatively inexpensive compared to Hopedale.

Davis Inlet

Davis Inlet (13N/15) is situated on the eastern side of Iluikoyak Island, approximately 290 km north of Goose Bay. The community is built on a sandy outwash deposit, which allows for excellent drainage. Exposed rock hills to the west of the community reach heights greater than 100 m a.s.l. The area is surrounded by a dominant spruce forest.

The area is underlain by anorthosite, anorthositic gabbro, leucotroctolite and minor gabbro, monzonite, granodiorite and ferrosyenite (Greene, 1970). Large surficial deposits (Figure 30) occur in the general area around Davis Inlet. Textural analyses of samples 84-3277 and 84-3278 (Figure 31) indicate the outwash terrace deposit is composed of fine to medium grained sand (Plate 9) containing 9-percent pebbles. Although this deposit lacks the quality to make good concrete or road-surfacing gravel, parts of it should be protected by zoning to ensure adequate aggregate resources to meet future needs.

Plate 9: *Five-metre sand exposure in abandoned quarry at Davis Inlet.*

Nain

Nain (14C/12), approximately 370 km north of Goose Bay, is the most northern permanent community within the study area and Labrador. Nain is also the most populous of the coastal Labrador communities. It is situated on the south side of Nain Bay near the mouth of the Fraser River. It is protected from the ocean by the many islands just off the mainland.

Nain is built on a moderately flat marine terrace (Figure 32) that has developed along the coastline of a northeast-oriented rock ridge, which rises to over 200 m a.s.l. The water supply is derived from a small stream in a valley trending southwest from Unity Bay. A barren hilly region is located to the south.

The general geology is similar to that of Davis Inlet; rock units are composed of anorthositic gabbro, leucotroctolite and minor gabbro, monzonite, granodiorite and ferrosyenite (Greene, 1970). Labradorite and soapstone are mined on a very limited basis, supporting a local craft industry (Nain Municipal Plan, 1981). Also, there has been some preliminary discussion on the use of labradorite as a building stone. (Labradorite chips set in concrete panels, and polished blocks of labradorite are available for general public viewing at the Newfoundland Department of Mines.)

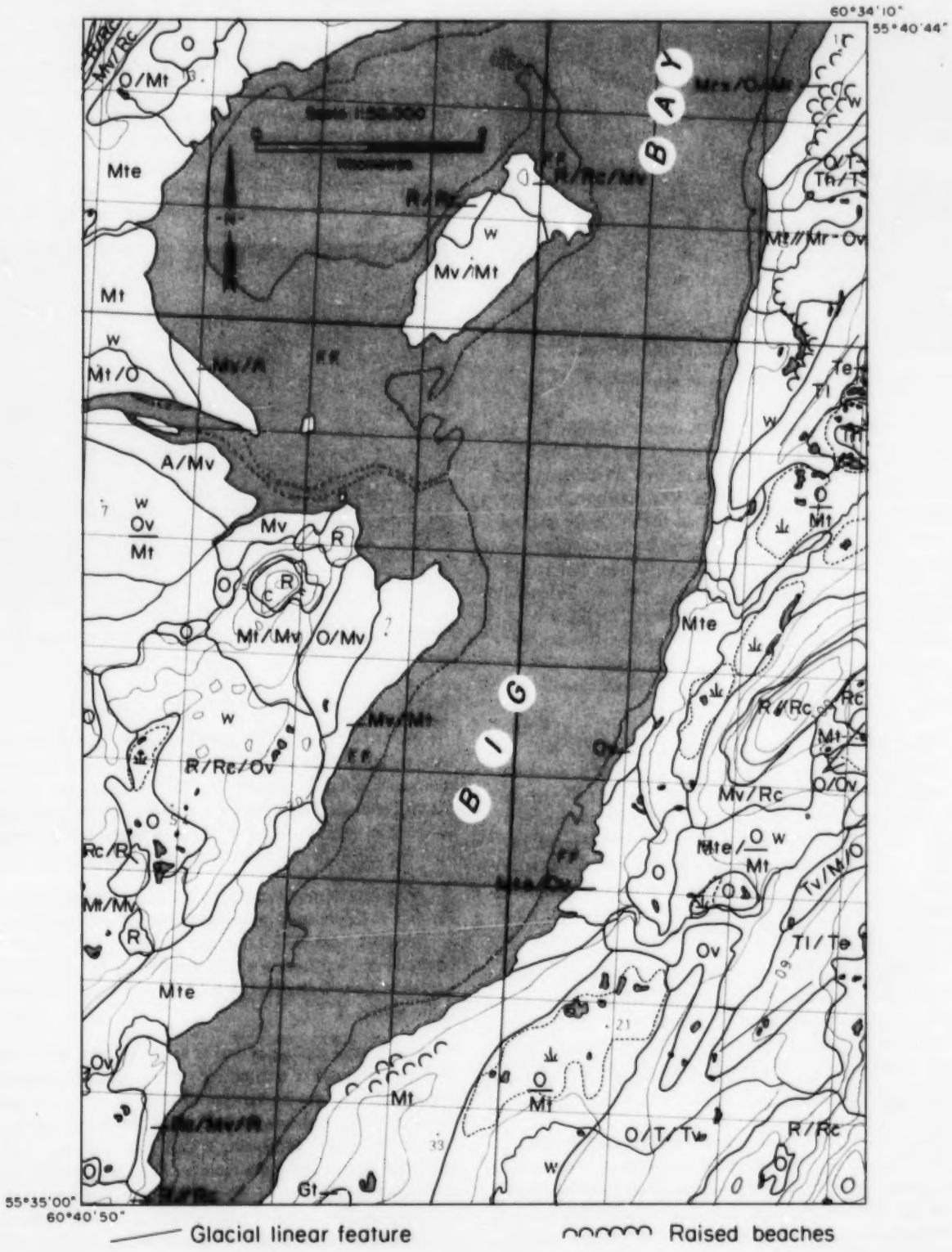

Figure 28: *Surficial-geology map for Big Bay, 1:50,000 scale, 13N/10 (see Table 6 for classification scheme).*

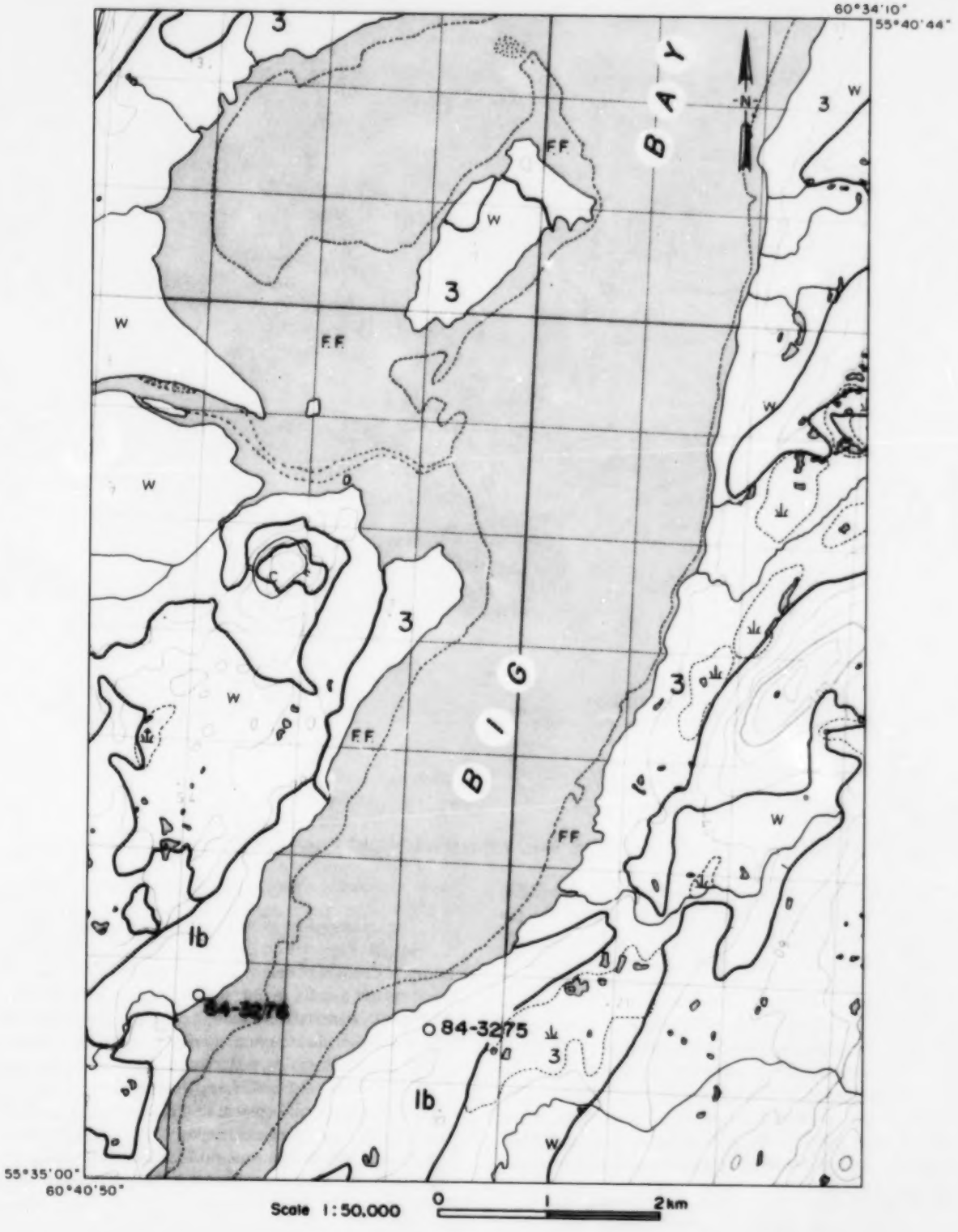

Figure 29: *Aggregate-resource map for Big Bay, 1:50,000 scale, 13N/10 (see Figure 6 for legend).*

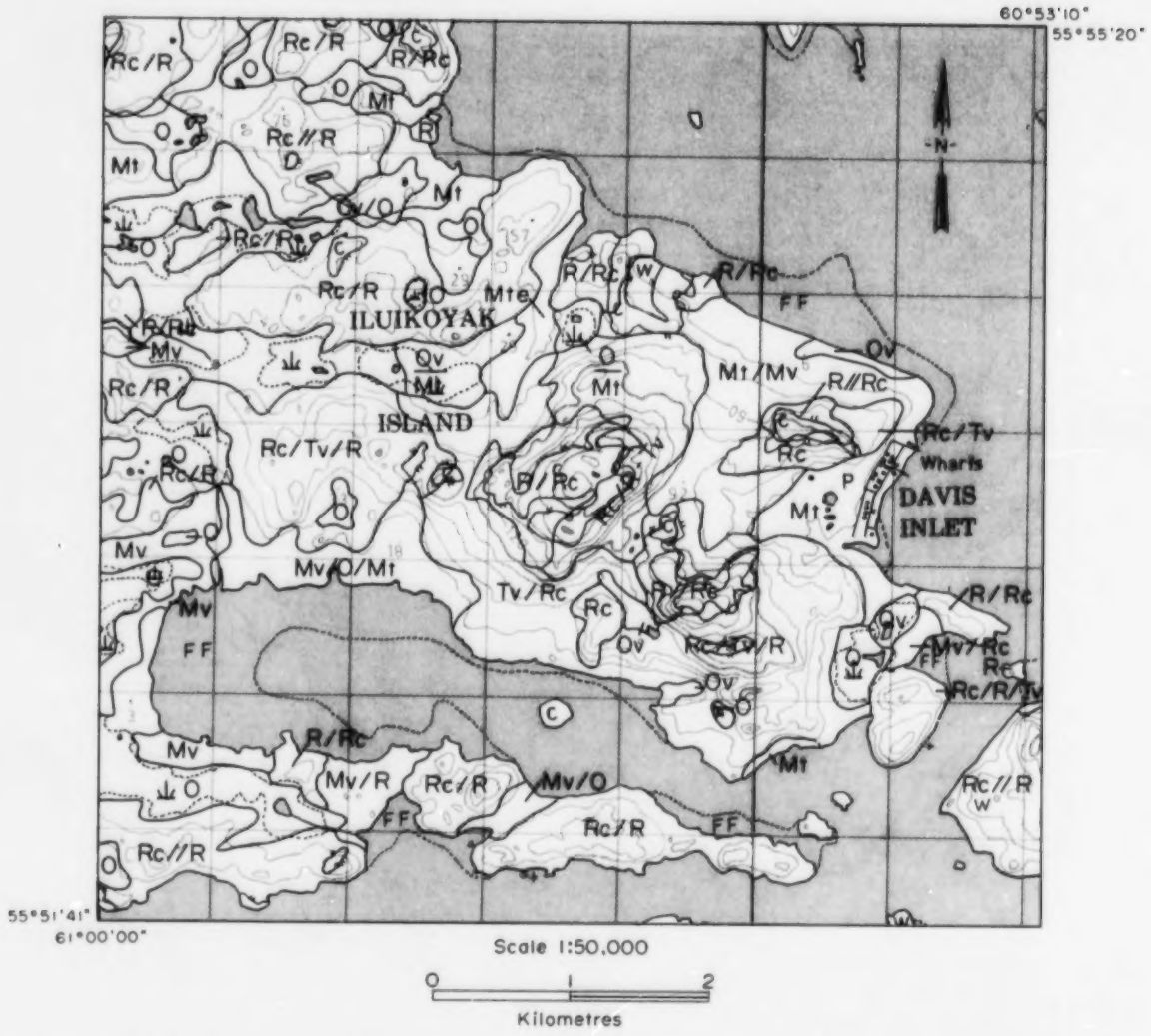

Figure 30: *Surficial-geology map for Davis Inlet, 1:50,000 scale, 13N/15 (see Table 6 for classification scheme).*

Rock outcrops are dominant on the hilltops surrounding Nain; sparce-to-moderate-density tree growth occurs in the valleys. Nain has adequate deposits of outwash material, composed of fine to medium grained sand containing some pebbles (Plate 10), but lacks high-quality aggregates.

Nain is fortunate in that it is situated in an area of extensive overburden, and borders a substantial undeveloped area. The overburden consists principally of tills and glaciofluvial outwash sands (Figure 33), allowing for relatively easy installation of water and sewer lines. Some of these sandy deposits should be zoned in community plans to ensure adequate reserves of aggregates are available to meet the local demand.

CONCLUSION

The communities of Williams Harbour, Charlottetown, Cartwright, Rigolet, Port Hope Simpson and Makkovik have adequate deposits of quality granular materials. Petrographic numbers are usually less than 300, indicating moderate-to-high-quality material suitable for most construction purposes. Due to the short field season, no petrographic analyses were conducted on samples collected in the communities of Postville, Davis Inlet and Nain, although large deposits of sand and/or gravel are present in these communities. In the areas containing adequate deposits, the designation of aggregate zones within specific localities will ensure that aggregate can be preserved to meet the present and future

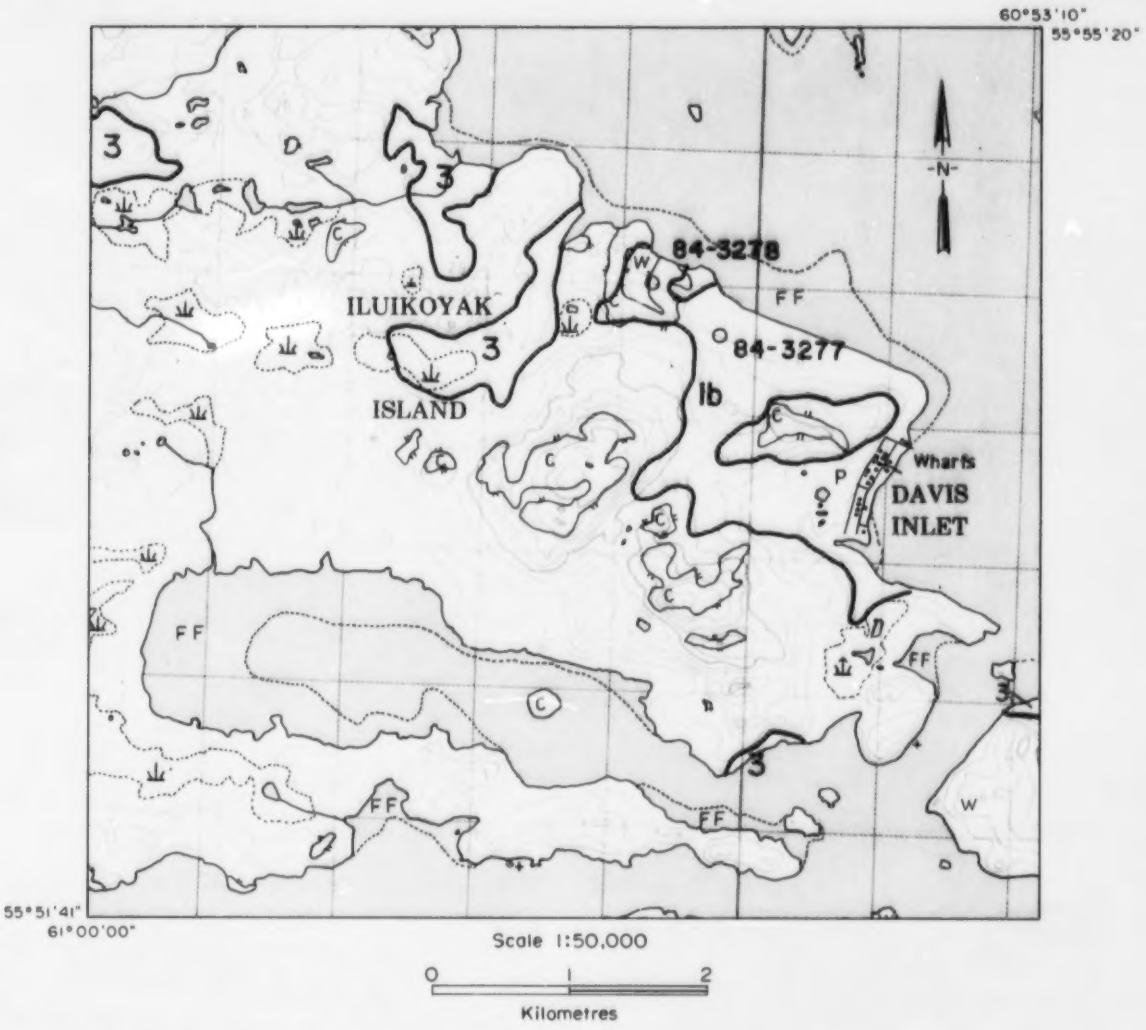

Figure 31: *Aggregate-resource map for Davis Inlet, 1:50,000 scale, 13N/15 (see Figure 6 for legend).*

demands of the domestic and commerical consumer. After the aggregate resources are depleted, quarry areas could be rehabilitated for other community uses such as housing and recreation.

The communities of Lodge Bay, Mary's Harbour, Fox Harbour, Paradise River, Black Tickle and Hopedale are devoid of quality granular aggregates suitable for construction purposes. Pockets of ballast materials consisting of silty tills are present in these communities. An assessment by Newfoundland Geoscience Limited (1985) in the community areas of Lodge Bay, Mary's Harbour, Williams Harbour and Cartwright indicate these areas to have potential armour-stone sites. In areas having low-quantity and low-quality aggregate, advance plans should be made now for future developments. Any major projects, e.g., airstrips, road building, water and sewer projects, in these areas must make allowance for getting materials by blasting and crushing bedrock. Information on bedrock types is given for this purpose; however, more detailed bedrock sampling may be required to locate potential quarry sites. If equipment for those projects is brought into a community, local councils, or other funding agencies, should consider it advisable to take advantage of the presence of this equipment to crush and stockpile additional materials to meet future requirements. The increased cost for stockpiling would be more than offset by the long-term gain of reduced construction costs, since mobilization costs for the blasting and crushing equipment often represents up to 60 percent of present contracts in coastal areas of Labrador.

It must be remembered that aggregate deposits of sand, gravel and stone, suitable for construction purposes, are a

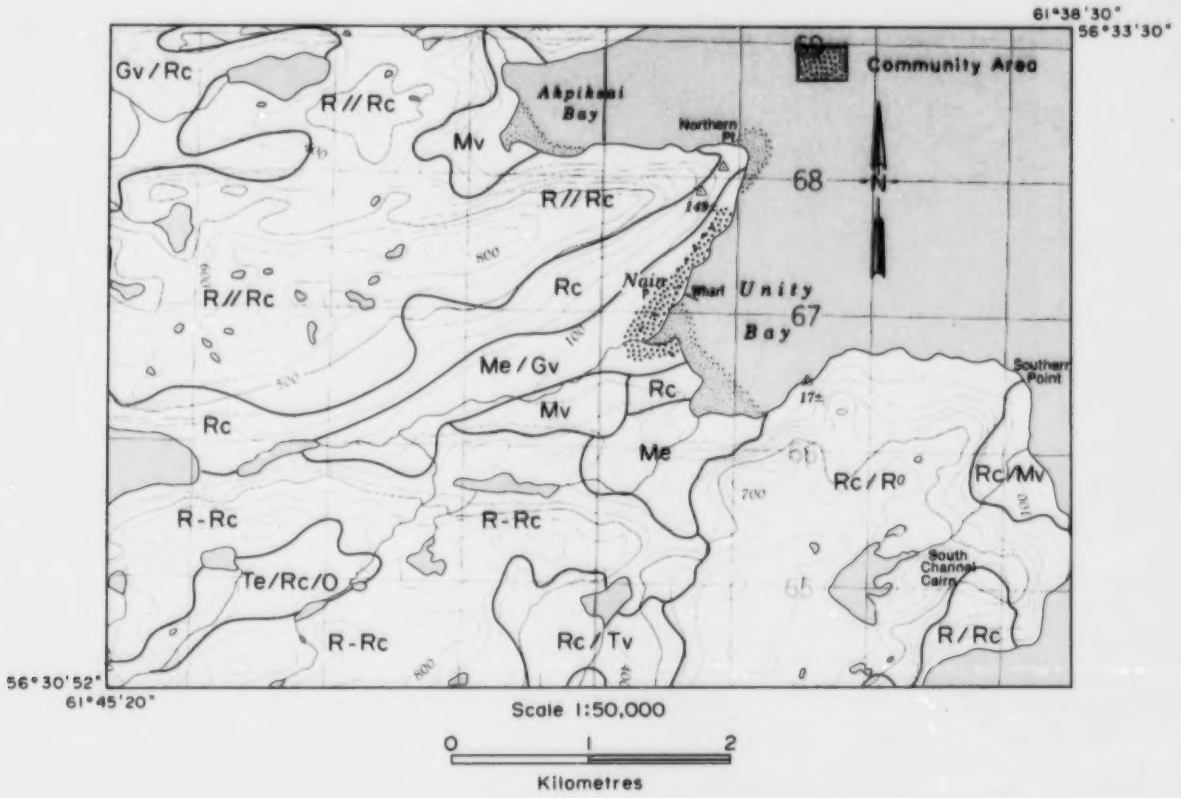

Figure 32: *Surficial-geology map for Nain, 1:50,000 scale, 14C/12 (see Table 6 for classification scheme).*

Plate 10: *Eleven-metre sand and silty-sand exposure along river bank near Nain.*

finite, nonrenewable resource. Their occurrence is related to geological deposition; they cannot be found everywhere. It is therefore to the advantage of the municipalities to ensure that any nearby reserves of aggregate are protected from conflicting land uses. One means of ensuring that these reserves are available is to see that a municipal plan is prepared for each community, and that each municipal plan contains an allocation of resource areas for extraction purposes.

ACKNOWLEDGMENTS

Dan Bragg is especially thanked for his capable assistance during the field program. Dan also provided the information on bedrock geology and conducted field pebble analyses. Wayne Tuttle in Goose Bay provided logistical support. Clarence Rumboldt Jr. and Mrs. James Sampson in Port Hope Simpson, Daryl Vators in Cartwright, and Steve Kipper in Rigolet provided helpful advice and great hospitality while we were working in these areas. A critical review by Martin Batterson and Doug Vanderveer resulted in substantial improvements to this paper.

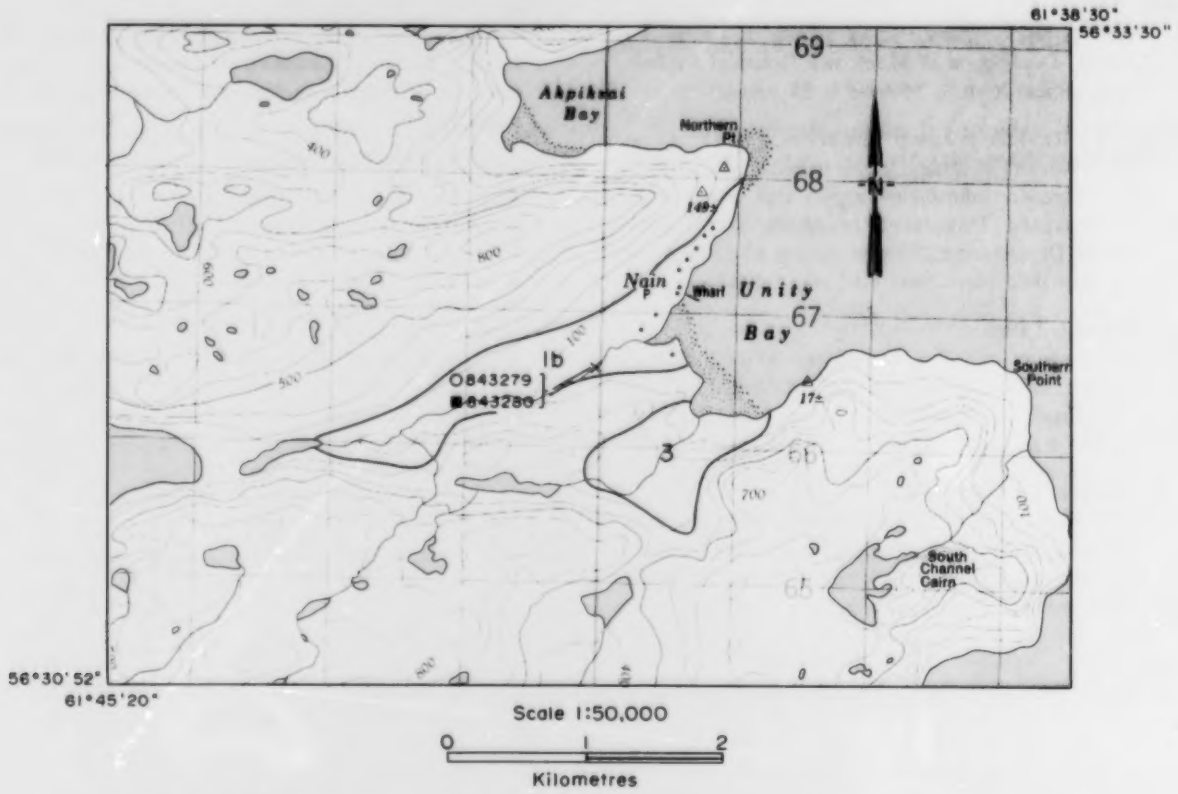

Figure 33: *Aggregate-resource map for Nain, 1:50,000 scale, 14C/12 (see Figure 6 for legend).*

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APPENDIX 1

Procedure for the petrographic analysis of coarse aggregate (revised CSA-A23.2.30; Bragg, 1986)

1. Scope

1.1 This Standard covers the procedure for the petrographic analysis of coarse aggregate samples. It is a method of appraising the quality of coarse aggregate and provides a numerical method of expressing and comparing the qualities of different samples.

2. Apparatus

2.1 The apparatus shall consist of the following:

(a) A hand lens of 10X magnification
(b) A magnet
(c) A pocket knife with a blade hardness between 5.5 and 6.0 on Mohs scale
(d) A hammer and anvil suitable for breaking aggregate particles
(e) A 5 percent solution of technical grade hydrochloric acid, 20° Bé
(f) A 400-millilitre polyethylene squeeze bottle with spout

3. Test Sample

3.1 A representative sample of pebbles between 16 mm and 32.5 mm are collected (usually around 100 pebbles).

4. Test Procedure

4.1 The sample shall be spread out on a flat working surface.

4.2 The aggregate shall be examined for coatings (such as clay), cementations and encrustations which may affect the bond with cement paste.

4.3 If clay balls or other particles which may break down in water or with normal handling are present, they shall be separated out at this stage of test.

4.4 The sample shall be examined visually for shape characteristics and the estimated percentage of crushed, flat or elongated particles noted.

4.5 On completion of the steps outlined in Clauses 4.1 through 4.4 the sample (exclusive of clay balls, etc.) shall be washed to remove any clay or dust coatings.

4.6 Each particle in the sample shall be identified by visual examination and sorted into the rock types listed in Table 1, Appendix 1.

4.7 In the identification procedure, the following points shall be noted:

(a) Particle shape
(b) Particle surface
(c) Grain size
(d) Texture
(e) Colour
(f) Mineral composition
(g) Significant heterogeneities (e.g., fossils, shale or clay partings, cementation)
(h) Chemical properties (e.g., backing, iron compounds)
(i) Physical properties (e.g., hardness, fracture, porosity)
(j) Physical condition (e.g., weathered, fractured)

5. Calculations

5.1 The percentage of each rock type shall be calculated to the nearest 0.1 percent.

5.2 The petrographic number (PN) shall be calculated as the sum of the products of the percentage of each rock type multiplied by the appropriate factor given in Table 1 and Table 2, Appendix 1.

NOTE: The scratch and acid tests will, with visual examination, usually be sufficient to classify most rock types, however, any rock types which may contain deleterious material should be examined microscopically.

Table 1 (Appendix I). Petrographic factors for pebbles of various compositions

Rock Type	Petrographic Factor	
	Range	Usual Factor
1. Sandstone	(1-6)	(3)
2. Shale	(10)	(10)
3. Mudstone	(3-6)	(6)
4. Siltstone	(1-6)	(3)
5. Conglomerate	(1-10)	(6)
6. Arkose	(1-6)	(1)
7. Argillite	(3-6)	(6)
8. Greywacke	(1-6)	(1)
9. Chert	(1-3)	(1)
10. Limestone	(1-6)	(1)
11. Dolomite	(1-6)	(1)
12. Quartzite	(1-6)	(1)
13. Granite	(1-6)	(1)
14. Gabbro	(1-6)	(1)
15. Diorite	(1-6)	(1)
16. Granite–diorite series	(1-6)	(1)
17. Felsic volcanics	(1-6)	(1)
18. Mafic volcanics	(1-6)	(1)
19. Intermediate volcanics	(1-6)	(1)
20. Felsic–mafic volcanics	(1-6)	(1)
21. Pyroclastics	(3-6)	(3)
22. Metavolcanics	(3-6)	(3)
23. Gneiss	(1-6)	(3)
24. Schist	(3-10)	(6)
25. Phyllite	(6-10)	(6)
26. Marble	(1-6)	(1)
27. Slate	(10)	(10)
28. Amphibolite	(6-10)	(6)
29. Ultramafic	(6-10)	(6)
30. Metasediments	(1-6)	(3)
31. Iron formation	(6-10)	(10)
32. Drift deposits	Any or all of the above	Any or all of the above

Table 2 (Appendix I). Petrographic legend

Petrographic Factor		Weathering Gradation		Final Petrographic Factors (Variations based on rock type)
Number	Classification	Number	Classification	
1	Good	1	Fresh	1
		2	Slightly weathered	1, 2
		3	Moderately weathered	3, 4
		4	Highly weathered	5, 6, 7
		5	Intensely weathered	8, 9, 10
		6	Residual soil	10
3	Fair	1	Fresh	3
		2	Slightly weathered	4, 5
		3	Moderately weathered	6, 7, 8
		4	Highly weathered	8, 9
		5	Intensely weathered	10
		6	Residual soil	10
6	Deleterious	1	Fresh	6, 7
		2	Slightly weathered	8, 9, 10

APPENDIX II

Test for sieve analysis of fine aggregate (revised From CSA-A23.2.2)

1. Scope

1.1 This Standard covers a procedure for the determination of the particle size distribution of fine aggregate, using sieves with square openings.

2. Apparatus

2.1 The apparatus shall consist of the following:

(a) Balance. The balance or scale shall be sensitive to within 0.1 percent of the weight of the sample to be tested;
(b) Sieves. The sieves shall have square openings and shall be mounted on substantial frames constructed in a manner that will prevent loss of material during sieving. Suitable sieve sizes shall be selected to furnish the information required by the specifications covering the materials to be tested. The woven wire cloth sieve shall conform to ASTM Standard E11, Wire-Cloth Sieves for Testing Purposes; and
(c) Oven. An oven of appropriate size, capable of maintaining a uniform temperature of 120 ± 5C.

3. Samples

3.1 Samples for sieve analysis shall be obtained from the materials to be tested by the use of a sample splitter or by a suitable method of quartering. Fine aggregate sampled by the quartering method shall be thoroughly mixed. The sample for test shall be approximately of the weight desired and shall be the end result of the sampling method. The selection of samples of an exact predetermined weight shall not be attempted.

3.2 Samples of fine aggregate for sieve analysis shall weigh, after drying, approximately 70 to 140 g. In no case, however, shall the fraction retained to any sieve at the completion of the sieving operation weigh more than 4 grams per square inch (0.60 gm/cm²) of sieving surface.

NOTE: This amounts to 140 grams for the usual 8-inch (200-mm) diameter sieve. The amount of material retained on the critical sieve may be regulated by the:
(a) Introduction of a sieve having larger openings than in the critical sieve; or
(b) Proper selection of the size of the sample.

4. Preparation of Sample

4.1 Samples shall be dried in an oven at a temperature of 120 ± 5C.

5. Procedure

5.1 For each sample of gravel or sand (i.e., samples which appear to contain less than 2 percent silt and/or clay material):
(a) Place sample in bank of seven sieves with screens sizes of 4 mm, 2 mm, 1 mm, 0.5 mm, 0.25 mm, 0.125 mm and 0.062 mm.
(b) This bank of sieves is placed on automatic shakers for 10-12 minutes.
(c) The material retained in each sieve is weighed on a balance as specified in clause 2.1(a).

5.2 Tills and other samples which contained a high silt and/or clay content were treated as follows:
(a) The sample was deflocculated using a sufficient amount of hydrogen peroxide solution (3 percent H_2O_2), to wet the sample.
(b) The sample was wet sieved through the 0.062 mm sieve and the water and silt clay material which passed through the 0.062 mm sieve was collected in a 8-litre plastic bucket.
(c) The plus 0.062 mm sand fraction, retained on the 0.062 mm sieve, was dried and sieved as per the procedures in 5.1(a), 5.1(b) and 5.1(c).
(d) The minus 0.062 mm fraction (water and silt and clay) was flocculated by adding a small amount of magnesium chloride (IN $MgCl_2$). After a 24 hour period, the excess water was siphoned off and the resultant silt-clay was dried and weighed.

6. Reporting

6.1 The results of the sieve analysis are recorded on a laboratory sieve analysis form.

APPENDIX III

Grain-size analyses, petrographic numbers, and deposit length, width and thickness

(See microfiche in pocket attached to inside of back cover.)

APPENDIX IV

Procedures for landform classification

(after Kirby *et al.*, 1983)

Surficial mapping outlines landforms and/or landform complexes, and special features such as glacial-flow indicators. Each category within a landform system is listed in the order of prominence of its occurrence in the defined area, and is separated from the other categories by a slash, e.g., Tv/R. In this case, T and R are the genetic categories and v is the morphological modifier. The areas have been divided so that normally a maximum of three landforms are identified within a given area. Six variations of landform systems are possible. The landform-classification system is also used to denote the approximate percentage of landforms occurring within an outlined area.

1) A single slash (/) is used to separate the different landforms. The slash can normally be used to separate up to three landforms, e.g., Tv (60-85 percent)/R (15-40 percent) or Tv (45-80 percent)/Th (15-40 percent/R (5-15 percent).

2) A double slash (//) is normally used to separate two different landforms, e.g., Tv (85-95 percent)//R (5-15 percent).

3) Stratigraphy or superposition of a preceding genetic landform over the following landform is represented as follows, e.g., $\frac{Ov}{T}$. This indicates that 95-100 percent of the area is an organic veneer over till.

4) Transition zones between two landform types where both have approximately the same percentage are denoted by a dash, e.g., Te (35-40 percent)–Tl (35-40 percent)/ R (15-20 percent).

5) Stratigraphy wherein more than one landform type overlays another landform type, e.g., $\frac{Ov/G}{T}$. This indicates that approximately 60-80 percent of the area is covered by Ov and 15-40 percent is covered by G and the area is completely underlain by till.

6) Stratigraphy indicating that only one unit overlays some of the other units, e.g., Tv/$\frac{Ov}{T}$ indicates that 60-85 percent of the surface area is covered by a veneer of till (Tv) and that the remainder of the area (15-40 percent) consists of organics over till.

It should be noted that you may get different combinations and variations of the above landform combinations, e.g., Te-Tl/ $\frac{O}{R}$ indicating that 15-20 percent of the area is covered by organics which are underlain by rock and the remainder (80-85 percent) is made up of approximately equal amounts of Te and Tl.

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